JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

Entered as second class matter May 7, 1906, at the Post Office at San Francisco, Cal., under the act of Congress March 3, 1879.

VOL. XXXV NO. 12 SAN FRANCISCO, SEPTEMBER 18, 1915 PER COPY, 25 CENTS

LIBRARY OF CONGRESS SEP 24 1915 TECHNOLOGICAL DIVISION

PACIFIC COAST ELECTRO-CHEMICAL POSSIBILITIES

BY J. W. BECKMAN.

ELECTRIC COOKING CONDITIONS IN THE WEST

BY W. R. PUTNAM, M. C. OSBORN AND S. V. WALT[illegible]

NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION CONVENTION

SELECTION OF PUMPS FOR IRRIGATION

BY C. REMSCHEL.

MATERIALS ADVERTISED IN THIS ISSUE

Batteries
Edison Storage Battery Co.

Boiler Feed Water Treatment
Dearborn Chemical Co.

Conduit
Sprague Electric Co.

Controllers
General Electric Co.

Diesel Engines
Busch-Sulzer Bros.-Diesel Eng. Co.

Electrical Supplies
Electric Ry. Supply Co.

Heating Appliances
Simplex Electric Heating Co.

Insulators
Hemingray Glass Co.
Pierson, Roeding & Co.

Motors
Century Electric Co.
Fairbanks, Morse & Co.
General Electric Co.

Piping
Pittsburgh Piping & Equip. Co.
The Schaw-Batcher Co.

Power Plants
Chas. C. Moore & Co.

Reflectors
Pacific States Electric Co.

Signs (Electric)
Federal Sign System (Electric).

Transformers
Westinghouse Elec. & Mfg. Co.

Transportation
Southern Pacific Company.

Turbines
Pelton Water Wheel Co.

Washing Machines (Electric)
Hurley Machine Co.

Wire (Trolley)
"Phono," Pierson, Roeding & Co.

Wire and Cable
The Okonite Co.
Sprague Electric Works.
Standard Underground Cable Co.
New York Insulated Wire Co.
Habirshaw Wire Co.

Alphabetical Index to Advertisers, Page 8 Where to Buy It in the West, Page 7

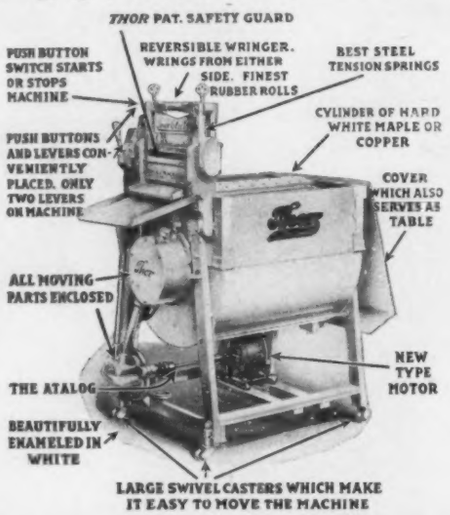
ELECTRICAL DEALERS

are making sales every day—those who are taking advantage of the big

Thor

ELECTRIC HOME LAUNDRY MACHINE

campaign, backed by our sales efforts.


THOR PAT. SAFETY GUARD
REVERSIBLE WRINGER. WRINGS FROM EITHER SIDE. FINEST RUBBER ROLLS
BEST STEEL TENSION SPRINGS
PUSH BUTTON SWITCH STARTS OR STOPS MACHINE
CYLINDER OF HARD WHITE MAPLE OR COPPER
PUSH BUTTONS AND LEVERS CONVENIENTLY PLACED. ONLY TWO LEVERS ON MACHINE
COVER WHICH ALSO SERVES AS TABLE
ALL MOVING PARTS ENCLOSED
NEW TYPE MOTOR
THE ATALOG
BEAUTIFULLY ENAMELED IN WHITE
LARGE SWIVEL CASTERS WHICH MAKE IT EASY TO MOVE THE MACHINE

They are making big profits. Make the most of this opportunity. Get a Thor in your store—show your customers what it means to home life—the ease, thoroughness and facility with which it does its work. It eliminates time—drudgery and expense from the duties of the housewife.

By the simple turn of the switch the Thor does the work—washing becomes a pleasure rather than a duty.

Thor machines are made for hard every day use—are equipped with a reversible wringer, hard white maple cylinder, powerful motor and the atalog attachment, which guards against overload and burnout. It's a "Safety First" machine—all working parts are enclosed.

Send in and get details. Put the Thor to work for you. We have an attractive partial payment plan for you to offer to your customers. Give us the names of some prospects in your section and we will work with you to make them see the desirability of having a Thor.

Talk it over with your nearest central station manager and enlist his co-operation. It means business for him. He is interested and will help.

Hurley Machine Co.

Chicago New York

Distributors for the Pacific Coast

PACIFIC STATES ELECTRIC CO.

Los Angeles Oakland Portland

San Francisco Seattle

HERE IT IS!

THE NEW HOLOPHANE

983 REFLECTOR

SCIENTIFICALLY DESIGNED AS THE RESULT OF CAREFUL ANALYSIS.

INTENSIFIES ILLUMINATION INSTEAD OF CONSUMING IT.

THE MOST EFFICIENT REFLECTOR FOR SHOW WINDOW AND ANGLE TYPE LIGHTING.

PUT THEM IN YOUR STORE WINDOWS AND SHOW YOUR MERCHANTS WHAT CAN BE DONE IN THE WAY OF ATTRACTIVE LIGHTING, ESPECIALLY DURING THE COMING HOLIDAY TRADE SEASON—RESULT TO YOU—QUICK SALES AND BIG PROFITS.

ORDER HOLOPHANE 983 NOW. BE FIRST IN THE FIELD WITH THIS NEW AND HIGHLY DESIRABLE REFLECTOR. YOU'LL BE GLAD YOU WERE THE LEADER.

PACIFIC STATES ELECTRIC CO.

The Modern Electrical Supply House

Distributors for the Pacific Coast

LOS ANGELES OAKLAND PORTLAND

SAN FRANCISCO SEATTLE

SEP 21 1915

©Cl.B340241

JOURNAL OF ELECTRICITY
POWER AND GAS
Devoted to the Conversion, Transmission and Distribution of Energy

VOLUME XXXV SAN FRANCISCO, SEPTEMBER 18, 1915 NUMBER 12

[COPYRIGHT 1915 BY TECHNICAL PUBLISHING COMPANY]

PACIFIC COAST ELECTRO-CHEMICAL POSSIBILITIES

BY J. W. BECKMAN.

(A brief review is here presented of Western conditions of electric power, labor, raw materials, markets and finances for electro-chemical development. This paper is condensed from one prepared for presentation at the San Francisco meeting of the American Electro-chemical Society, Sept. 17, 1915. The author is chemical engineer with the Great Western Power Co.—The Editor)

Columbia River at Head of Five Mile Rapids.

Forty-three per cent of the potential water power of the United States is to be found in the comparatively narrow strip of land bounded by the Cascade Mountains and the Sierras in the East, the Pacific Ocean on the West, by Canada in the North and Mexico in the South.

U. S. Government statistics give the minimum potential water power in the United States as 26,736,000 h.p. Of this, 11,504,000 h.p. is available in the states of Washington, Oregon and California, Washington having 4,932,000 h.p., Oregon 3,148,000 h.p. and California 3,424,000 h.p. Less than 7½ per cent of this has been developed as shown in the folowing tabulation:

	Developed h.p.	Per cent of Possible Power.
Washington	306,000	6
Oregon	105,000	3
California	430,000	8

The potential water powers of Alaska have never been estimated, but conditions in the southeastern section of the territory, especially, are such that they promise in a way to rival Norway, as to cheap and abundant water power. So far only a very small fraction of the available powers has been developed.

The cost of electric power on the Pacific Coast has often erroneously been thought prohibitive for electrochemical industries. Power can be obtained close to the generating stations as cheap, if not cheap-

er, than the prices generally quoted for power at Niagara Falls.

Of course, the power at the end of a long transmission line is considerably higher priced than close to the generating station, but even so, if the industries can operate on so-called "off-peak" power at such a point, big reductions are offered the consumer. The size of this reduction depends on the consumption, and may even amount to 40 per cent of the prevailing price.

All through this section of the United States there is still a great deal of water power, the development of which is not yet even projected, and many of the sites are so located that their development would be exceedingly cheap; but on account of somewhat remote location, scarcity of population and lack of electrochemical enterprise, they might be failures if developed at the present time.

Labor.

In a way it is futile to formulate opinion as to labor and its conditions on the Pacific Coast while the terrific struggle is going on in Europe, where thousands of men are being permanently taken out of the labor market. But in spite of this, it is problematical whether the opening of the Panama Canal will have a marked influence on the labor market of the Pacific Coast.

It is significant of the labor on this coast that it is composed practically exclusively of either native-born Americans, or of foreign-born Americans who have to a great extent lost touch with the European country from which they originally hailed.

Exceptions to this are naturally the Orientals and Hindus, who seem to devote the greater part of their activity to agricultural and logging occupations, and as is well known they are not met on the Pacific Coast, justly or unjustly, with a "welcome." Through international "gentlemen's agreements," and through exclusion, the inflow of this type of labor has to a great extent been limited, if not eliminated.

The labor, therefore, that has to be counted with at present, is really the best type of European: The man who is familiar with both the language and the ways of the land, the man who is wide-awake among his own countrymen and has been able to shake the shackles of the congested foreign sections of the large Eastern cities, the squalor of its mining and manufacturing towns, and, escaping the padrone, has taken his destiny in his own hand. It can, from this, be understood that industries operating on the Pacific Coast get the pick of the Eastern labor market.

For a long time much the same conditions will prevail. Since European laborers are gregarious, they go only to centers already established by their own countrymen, and from such a point they branch off. Only when a large population of directly imported foreign European labor has collected in Pacific Coast centers, due to industrial advantages, will there be a direct influx of European labor of any magnitude to the Pacific Coast.

The cost of labor does not differ very materially on the Pacific Coast from that prevailing in Chicago. As a result of an extensive investigation of prevailing labor prices, it is found that unskilled labor gets $1.50 to $3 per day and skilled labor $3 to $3.50 per day. The average working day is eight hours.

The climate of the Pacific Coast should not be overlooked in considering labor conditions and labor costs. With the modern researches into efficiency and the effect of climate on same, it is well to appreciate that the equitable climate of the Pacific Coast, with mild winters and cool summers, is very stimulating and the average annual output of a laborer is materially greater on the coast than in the East.

Labor is fairly strongly unionized in some sections of the coastal states, while in other the open shop prevails.

Refractories.

Magnesite. Considerable has been said recently about California magnesite, and too much cannot be said about it, since the California magnesite is extremely refractory, being practically pure magnesium carbonate. With suitable admixtures it should furnish an ideal material for furnace linings. There are large deposits of this mineral in California, and so far these deposits have not been extensively worked.

Asbestos. Short as well as long fibred varieties are to be found in large quantities in California and other localities of the Pacific Coast.

Kieselguhr. Large deposits are found, of such nature that solid blocks can be cut out and used in furnaces and other constructions.

Fire Clay. Very high quality is being dug, and excellent fire brick are being produced on the Pacific Coast. The bricks have been giving better results in open-hearth operation here than the best standard fire bricks of the East.

Dolomite. Good and extensive deposits are found at various points on the Pacific Coast.

Quartz. Quantities of pure quartz deposits are available, in rock formation as well as sand.

Most of the materials mentioned above occur in various quite widely distributed points on the Pacific Coast, and mostly in easy reach of transportation.

Reducing Materials.

Anthracite. The Pacific Coast is not yet as favored as the East with high grade anthracite coals. Alaska is as yet only a potential producer of coal, but this territory promises to supply the west coast in the near future with high grade anthracite coal, low in ash and sulphur.

Soft coal. Alaska, British Columbia and Washington are all producers of soft coal, and at various places on the coast lignites are located. These coals do not have any value at present, except for ordinary purposes. China, Japan and Australia supply the coast with coal, some of which is high grade anthracite of quality and at prices which make it possible for them to compete advantageously with coal brought in from the East.

Charcoal. Many of the densely wooded districts of the Pacific Coast have great abundance of timber, which in many cases would really be improved if part of it were carefully cut, and burnt into charcoal. Southeastern Alaska, especially, is covered by overgrown timber, ideal for charcoal burning. It is practically obtainable at no cost, and the charcoal would

provide a pure carbonaceous material, comparatively cheap, for reducing purposes.

Natural gas. The enormous oil fields of California furnish in many cases, besides oil, great quantities of gas, an ideal reducing material in metallurgical processes.

Oil. Present in great abundance, much of it practically free from sulphur. It offers in itself all the essentials for reducing metals from their ores. Present day technique has as yet not evolved ways and means by which the two latter reducing agents can be used with success in electrometallurgical processes, but since the essentials necessary in reducing exist in natural gas and oil, it is purely a question of application of thermal and mechanical details to make such processes operative.

Lampblack. As coke is obtained as a by-product in the manufacture of illuminating gas from soft coal, so a very fine lampblack is produced in gas plants operating with crude oil. The lampblack formed is practically pure carbon, except for a small amount of heavy oil mixed in with it. A considerable quantity of this material is produced every day at the various gas houses along the coast, and forms an ideal reducing material, since it contains no ash and no sulphur. At present this material is a by-product, and offers in many cases the problem of how to most advantageously dispose of it. On account of its physical condition and its purity it offers an ideal raw material for the manufacture of carbon electrodes, for which there already is a demand on the Coast, and this demand is bound to grow rapidly from now on.

Fluxing Materials.

Limestone. Large and conveniently located deposits of limestone of high degree of purity are to be found at many and varied locations on the Pacific Coast, offering ample, cheap and certain supply of this important mineral. With the cheap fuel available, burnt lime can be produced to advantage at about $3 per ton.

Salts. Especially in the arid regions of southern part of California, in the deserts, there are large deposits of various salts. Sodium sulphate, sodium carbonate, sodium chloride, and sodium nitrate are all found. Sodium chloride is also obtainable very cheaply along the beaches of the Pacific Coast. The salt ocean water is evaporated in shallow basins by means of sun and wind, and deposits are formed of practically pure salt, suitable for industrial or domestic purposes. This salt can be produced and stacked ready for transportation for about $1.50 per ton.

What promises to be of interest not only to the electrochemical industries but also to the world at large is the occurrence of considerable quantities of potassium chloride in the southern part of California. These deposits are being developed and will shortly be a source of potash to be considered for more than one purpose.

The increasing demand for boron and its compounds can be filled from the large borax deposits in the Pacific states.

Metalliferous Raw Materials.

Iron ores. That the Pacific Coast holds some unusual iron ore deposits, unusual both as to size and quality, is not always realized. The quality of some of the ore is such that it can compete with some of the best Swedish ores. There is no reason why the Pacific Coast, with abundant supply of high grade iron ores, quantities of cheap oil and charcoal, and hydroelectric power obtainable in great quantities at low prices, should not be an iron producing section of the world, the products of which would figure largely on the world's markets. The time is not distant when such will be the case.

All the necessities for an extensive steel industry are to be found in the shape of ores suitable for the manufacture of alloys, such as ferro-manganese, ferro-chromium, ferro-vanadium, ferro-silicon, ferro-tungsten, ferro-molybdenum and others.

Barium, both in the shape of sulphate and as carbonate, is to be found in large deposits and in accessible localities.

Bauxite, suitable as raw material for aluminum manufacture, can be found; so also the tin ore cassiterite.

Zinc occurs abundantly; in many mine operators' opinions, too abundantly, in connection with copper ores, and the mining world is eagerly wating for some commercial process to treat copper ores containing considerable amount of zinc, recovering both the copper and zinc.

Copper occurs in great quantities, and in lesser quantities lead, silver, nickel, mercury and uranium. Gold and platinum, occurring only in native condition, are of no special interest in this connection.

In making mention of these various metals, it is with the intention of showing the multitude of possibilities open to the electro-chemist and electro-metallurgist, and although many of these metals are at present obtained from ores found on the Pacific Coast, by means of operations more or less costly, there still remain possibilities where these methods can be substituted both economically and efficiently by utilizing new forces and new agents.

Possible Industries.

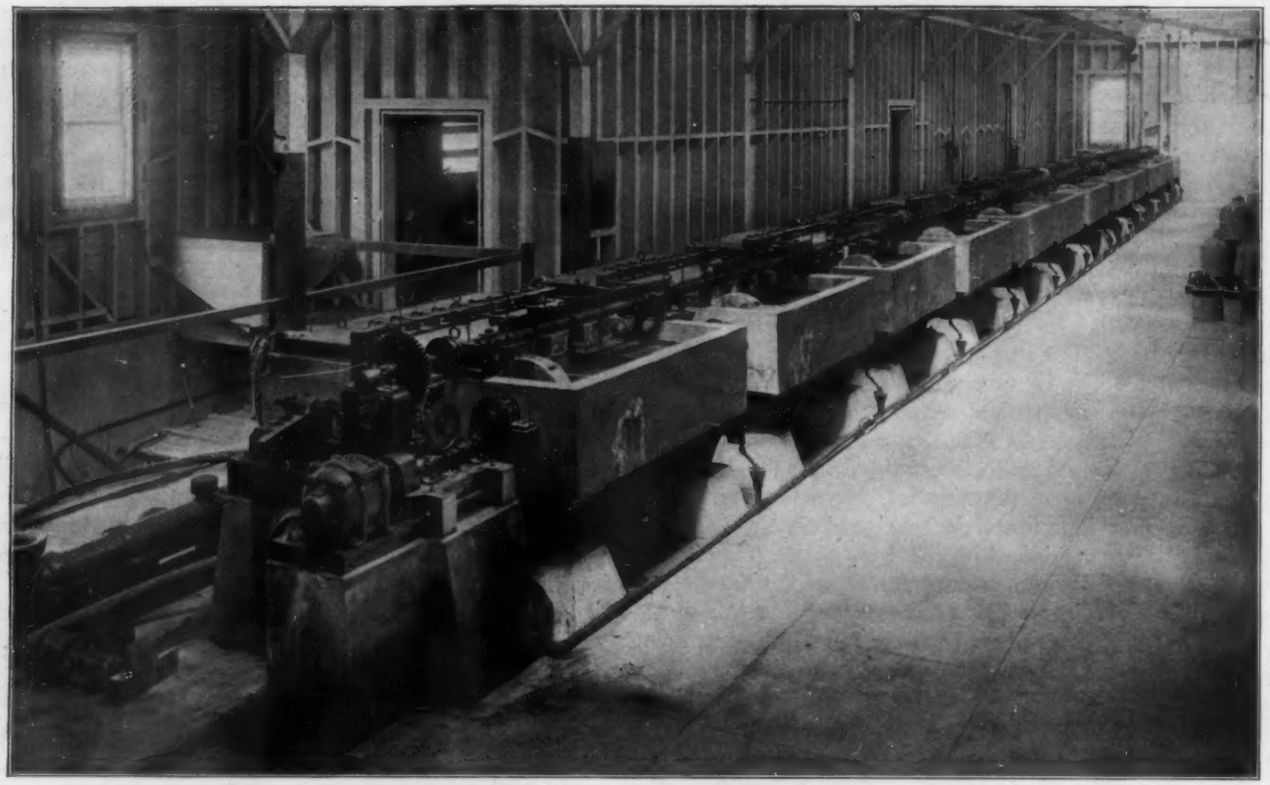
From the foregoing it is apparent that there are a great number of industrial possibilities here, but there are a few that are perhaps more apparent than others.

The caustic soda and bleaching powder industry is the most promising at the present time for an early development. This industry and its possibilities have been thoroughly investigated, and it is established that a medium-sized caustic acid plant can be operated not only successfully but very profitably on the Pacific Coast.

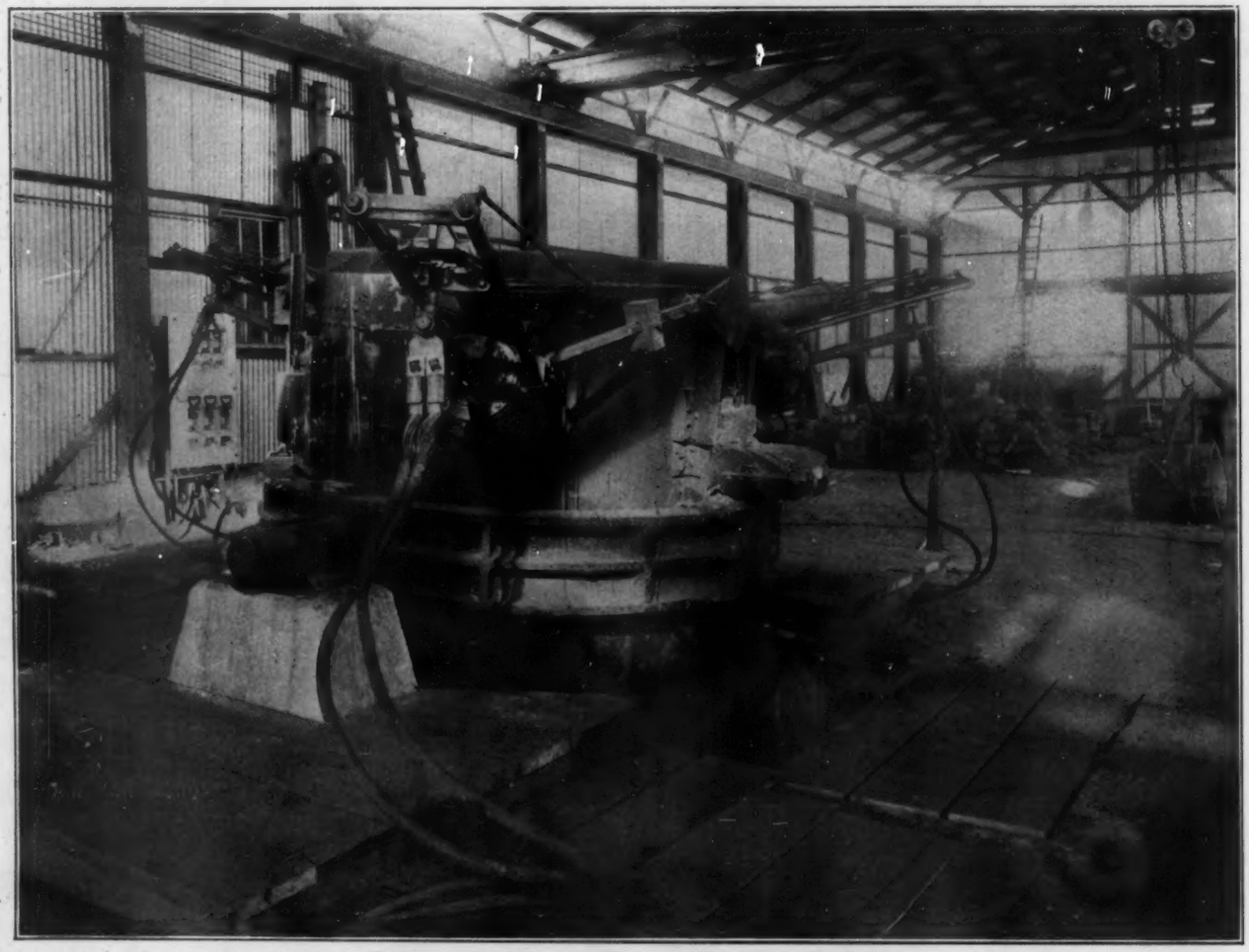
Potassium chlorate manufacture is another industry which should have special possibilities here, with the raw materials necessary for it produced on this coast.

The demand for calcium carbide in South America is great, and also in the mining districts of the Western part of United States. The raw materials are obtainable here and the manufacture of carbide should become a flourishing industry.

Nitrogen fixation industries seek very cheap power, and such power is available here, as well as a very large market for the product. The soil of the coastal region is being rapidly depleted of nitrogen,



Cell Room of Electro-Alkaline Co., Oakland, Cal.



Stassano Electric Arc Furnace, Long Beach, Cal.

while in some sections the soil is physically well adapted for farming purposes but lacks nitrogen. Artificial fertilizer is therefore a great and urgent need for this part of the United States.

The iron and steel industry, as has been indicated before, has great possibilities on the coast, and although the present electric shaft furnace plant in Northern California has not been a total success, there is every reason to believe that success would be won if past experience as well as present practice in Sweden were utilized, together with the application of new principles using oil, or oil and charcoal, as reducing agents. The demand for high grade steel castings, produced by means of the electric furnace, is large here, and although there are now three small furnaces operating on the coast there is place for a number of others.

The Pacific Coast should logically be the world's distributing center for cyanide used in gold extraction. With raw materials suitable for the manufacture of this salt available, electric power, and the market all close at hand, such an industry should flourish.

Aluminum manufacture, lead reduction, zinc production, and the electrolytic refining of copper are other electro-chemical industries which should be developed on the Pacific Coast. Practically all of the blister copper produced here is shipped East for final refining, when in reality conditions are perhaps even more favorable for this process on the Pacific Coast, where the metal is produced, than in the East.

Markets.

Sweden and Norway are looked upon as the world's electro-chemical countries par excellence. Cheap water power has been held up as one of the reasons of this position, and it is worth noting that if Sweden and Norway had as many opportunities for large, cheap power installations as there are on the Pacific Coast, these countries would dominate the world with their electro-chemical products. But the electro-chemical industries there would be total failures, even if the processes were working to a nicety, if they had no market for their products.

The total population of those two countries amounts to 10,000,000 people, which to a great extent have agriculture or fishing as their occupation, thus furnishing only limited domestic market possibilities. Still, the industries there are successes in spite of limited home markets, because they have looked to markets beyond the boundaries of their countries, entered the world markets and there found outlets for their products. These markets are free and open to each progressive nation or individual.

Electro-chemical industries on this Coast have to be inspired with the same desire as those in Sweden and Norway, since the population of the Pacific is about 5,000,000 people. With more than half the world's population dwelling in lands facing the Pacific Coast, these markets are just waiting to be taken by industries located on this coast.

It may justly be said that the greater part of these countries facing the Pacific Coast are populated by people that are still living under primitive conditions, and their demands are limited. Such assumption may be partly correct today, but early experiences show that as these countries get more and more in touch with the well organized nations of the world, their needs for the products of these nations increase correspondingly.

This fact is startlingly apparent from statistics obtainable from the Philippine Islands, showing the imports prior to American occupation of the Islands in 1899 and after.

Figures received from the War Department's Bureau of Insular Affairs show that imports have more than quadrupled during the fifteen years the Philippine Islands have been under U. S. control, while they were practically stationary during the six years prior to U. S. occupation. The increase is quite significant, indicating the growth of imports as a country gets in touch with more modern conditions.

Many of the South American and far Eastern markets are now open, leaving unprecedented commercial opportunities for industries located on the Pacific Coast.

Financial Conditions.

There was a time in the history of the Pacific Coast when gold mines and oil wells were the only undertakings which would interest men with capital. Fortunes were made and lost over night. The Pacific Coast is outgrowing this neurotic condition.

Men with money are still eager to make more, but wild, sky high flights in the financial world have lost their interest, financiers are as conservative on the Pacific Coast as they are in New York City.

It is natural for the West to look East for capital, but it is also equally natural for the West to look inside of its own boundaries for capital. The time is not far distant when financially the Pacific Coast, although not emancipated from the East, since this is impossible, will walk side by side with New York and other Eastern money centers, equally prepared to take as well as to give assistance in the realm of finance.

Conclusions.

Any industry operating on the Coast would have to look to other markets than the local ones for its products. With more than half the world's population facing the Pacific Coast, an industry here has greater commercial possibilities and opportunities than one located in Sweden or Norway, which have large products. With more than half of the world's population facing the Pacific Coast, an industry here has greater commercial possibilities and opportunities than one located in Sweden or Norway, which have large nearby, fully developed markets, but also keen competition to contend with.

But for a few small electro-chemical industries on the coast, electro-chemistry would be unknown here, excepting by its name. The Pacific Coast has as yet not financial strength, nor experiences enough, to build up these industries alone.

The possibilities are here; the Pacific Coast is quickly waking up to this fact, but is forced yet for sometime to look East for its electro-chemical stimulus.

SELECTION OF PUMPS FOR IRRIGATION.

BY C. REMSCHEL.

(Concluded.)

Power Plunger Pumps.

Power plunger pumps are built in either one, two, three or more cylinders. When the pump has two cylinders it is known as a duplex pump, and when three cylinders as a triplex pump, and so on.

These pumps are built either single or double acting. The action of the single acting is to exert suction on the forward stroke and pressure on the backward stroke; while the action of the double acting pump is that the piston exerts suction and pressure in both strokes and thereby gives a nearly continuous flow through suction and discharge pipe.

On account of the simplicity of the single acting pumps, they are used to a greater extent than double acting. To reduce the shocks that occur to a certain extent in double acting pumps, an air chamber is frequently attached to the discharge pipe so that the confined air may distribute and lessen the shocks that would otherwise be concentrated on the discharge pipe. Power is transmitted to these pistons by means of gears and driving rods usually built as part of the pump. The losses that take place in the power plunger pump takes place in the water passing through the valves and the friction in the gears and bearings. These losses are greatly reduced by making the valves large and reducing the speed as low as possible. Power plunger pumps are usually installed where the water is obtained either from a surface source or near the surface, and where the lift above the surface is large. This type of pump when pumping against a high head is very efficient and the following examples of the efficiency of single acting duplex and triplex pumps will tend to show for what work they are best adapted.

Efficiencies of Single Acting Duplex and Triplex Plunger Pumps.

Size of Cylinders.	Head in Feet. 50	100	150	250	350
1¼ to 2.....	25	40	50	60	70
2½ to 3.....	33	45	55	65	75
4	40	55	60	70	78
5	50	60	65	75	80
6 to 7.....	50	60	70	78	82
8 to 14.....	50	65	72	78	83

The capacity of power plunger pumps depends on the diameter of the cylinder, the length of the stroke of the piston and the number of strokes of the piston per minute. The following is an example of a few sizes of triplex single acting pumps.

Capacity of Single Acting Triplex Pumps.

Size of cylinders.	Length stroke.	Strokes per min.	Gals. per min.
3 inch	6 inch	50	27
4 inch	6 inch	50	50
5 inch	8 inch	45	90
6 inch	8 inch	45	130
7 inch	10 inch	42	210
8 inch	10 inch	42	275
9 inch	10 inch	42	345
10 inch	12 inch	40	490
12 inch	12 inch	40	700

Air Lift Pumps.

Air lift or compressed air pumping plants consist of one or more air lift pumps, the air compressor with receiver and motive power and the necessary piping to deliver the compressed air from the receiver to the pumps. There are several different types of pumps; one that is most extensively used is where the discharge pipe is placed inside of the casing extending below the water to a depth equal to one and one-half to twice the lift measured from the water surface. The air pipe is usually placed inside of the discharge pipe; however, in some cases is placed on the outside between the discharge pipe and the well casing. Whenever this is done the capacity is cut down, as the discharge pipe has to be smaller to provide for the air pipe. These air pipes are usually connected at the bottom of the discharge pipe to a foot piece, of which there are a great many different patented designs, but all are of the same general principle and efficiency. The object of these foot pieces is to admit the air evenly into the discharge pipe. In some instances the well casing is used as the discharge pipe, in which case the foot piece is left off. This type of pump has a greater capacity for the same size casing but is not nearly as efficient. The relation between the volume of air supplied and the volume of water pumped has been found by experiment to be as follows:

Head in feet.....	10	20	30	50	100
Ratio cu. ft. air / cu. ft. water.	1.0	1.5	2.0	2.5	3.0

The proper size of air pipe for different size casings and the capacity to be expected are about as follows, depending upon the lift and submergence:

Capacity of Water That Can Be Expected With Air Lifts.

Size Casing.	Size Air Pump.	Capacity.
3½ inch	1¼ inch	80 to 150 g.p.m.
4 inch	1½ inch	100 to 150 g.p.m.
5 inch	2 inch	150 to 250 g.p.m.
6 inch	2 inch	275 to 375 g.p.m.
8 inch	2½ inch	500 to 650 g.p.m.
10 inch	2½ inch	775 to 1000 g.p.m.

The air lift system even under the most favorable operating conditions is not as efficient as either the centrifugal or power plunger pumps. The over-all plant efficiency rarely exceeds 40 per cent.

The advantages claimed by air lift systems are as follows:

First: Can pump a greater capacity out of well than by any other system.

Second: Able to pump sand and gravel, if in the water, without damage to the system.

Third: Possibility of operating a number of wells located a great distance apart from the central plant.

Having described the different types of pumps let us now consider as to what is required in the selection of the proper pumping plant. The factors which decide the selection of the plant can be classified as follows:

No. 1. Capacity of plant.
No. 2. Kind of pump.
No. 3. Class of driving power.
No. 4. First cost.
No. 5. Fuel cost.
No. 6. Cost of fixed charge and attendance.

These factors are interdependent and should be considered together. The importance of each of these factors varies with the local condition and for that reason it is not possible to state definite rules which can be applied to all cases. Consequently a study of each of the factors is necessary in every case.

Capacity of Plant.

The capacity of the plant depends on the area to be irrigated, the amount of water required on the land and the period of operation. The tendency, heretofore, has been to install a plant of too great a capacity and operating it for a short time only during the irrigation period. This had the disadvantage of increasing the first cost, which naturally increases the fixed charges such as interest on the capital invested, the depreciation and fund necessary to provide for renewal making the cost too high. Continuous operation requires continuous irrigation and attention to the pumping plant, neither of which is desirable. The continuous irrigation can be taken care of by a reservoir that will regulate the hours of irrigation. Constant attention cannot however be disposed of so easily. If an engine is used it is essential to have someone in constant attendance, which is not always convenient and the practice has been wherever possible to put in a plant having sufficient capacity so that it is only necessary to operate during daylight hours. When an electric motor is used the attendance question is practically eliminated, as the motor and pump can operate at least 10 or 12 hours without attention. This feature plays quite an important part in the selection of the machinery. Continuous operation when using electric power enables the consumer usually to obtain a low rate. This in conjunction with the low first cost of the machinery makes the cost of operation lower for electric power than any other system.

Area Acres.	30 days.	20 days.	15 days.	10 days.	5 days.
5	19	28	38	56	113
10	37	56	75	112	225
15	57	85	113	170	340
20	75	113	150	225	450
30	113	169	225	338	675
40	150	225	300	450	900
60	226	338	450	675	1350
80	300	450	600	900	1800
120	450	675	900	1350	2700

Necessary capacity in g.p.m. to give 6 in. depth of the machinery usually makes the cost of operation lower for electric power than any other system.

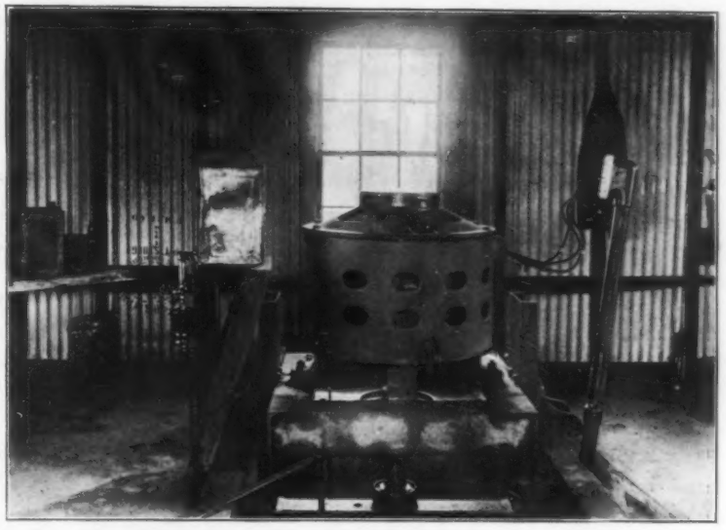
The following table shows the number of acres irrigated six inches deep each month with certain constant flowing water:

G. P. M.	30 days.	20 days.	15 days.	10 days.	5 days.
100	27	18	13	9	4
150	40	27	20	13	6½
225	60	40	30	20	10
300	80	53	40	27	13
400	100	71	55	35	18
700	190	127	95	63	32
900	240	160	120	80	40

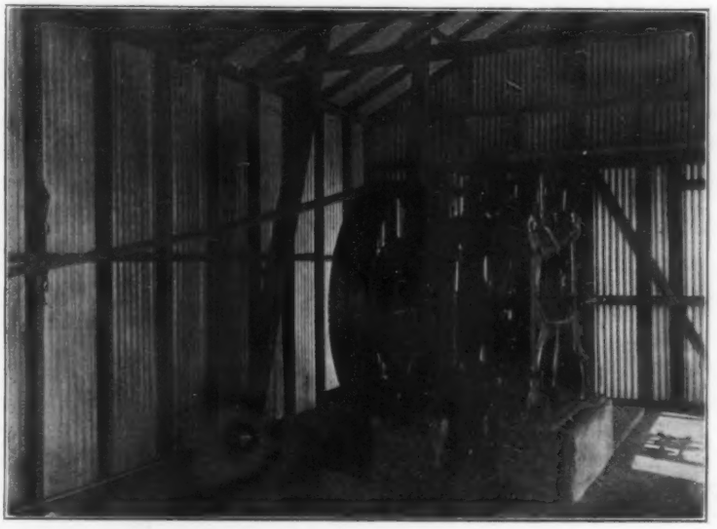
Kind of Pump.

Where a small quantity of water is required and the lift above the surface is high, the water clean, free from sand or silt, a power plunger

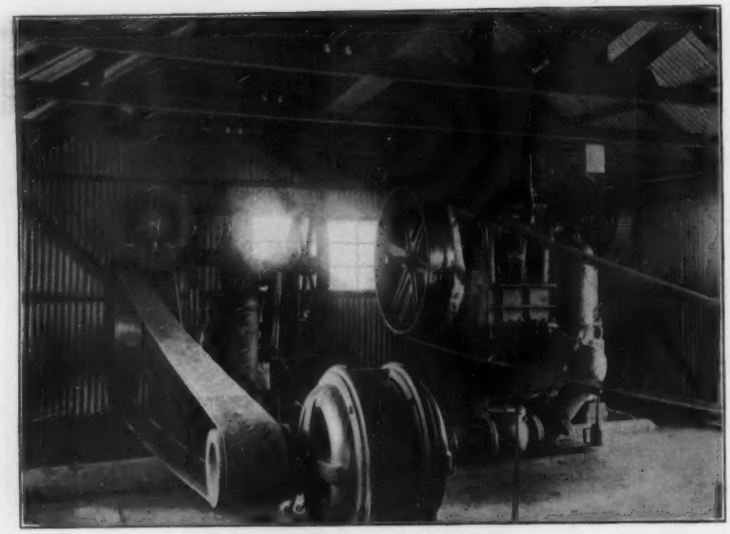
100x100x4 ft. Dirt Reservoir—G. E. Bunker Plant, Ferris Valley.



Vertical Centrifugal Pump in Steel Frame Direct Connected to Motor. Wm. Newport's Plant No. 3, Perris Valley.

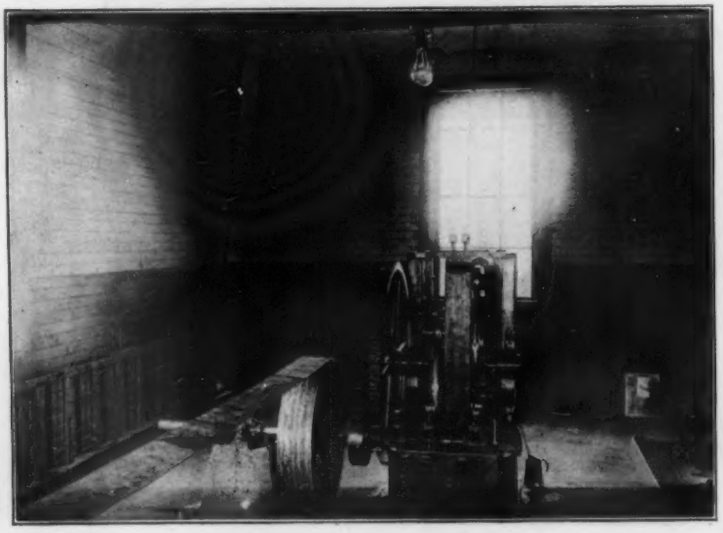


Deep Well Plunger Pump—Municipal Plant City of Perris.



Two Triplex Plunger Pumps—Nuevo Land Company, Perris Valley.

Belted Vertical Pump—Nuevo Land Company, Perris Valley.



Power Deep Well Plunger Pump—Santa Fe Ry., Perris Valley.

is undoubtedly best suited. If the water is near the surface, the triplex pump would be best suited, but if the water level is a considerable distance from the surface, a deep well plunger pump should be used. If in the above mentioned cases the water should be full of sand or silt, it would be best to use either a volute centrifugal or deep well turbine pump.

When a large amount of water is required to be pumped a moderate lift the volute centrifugal is by far the best pump to use. However, where the lift is extremely high and constant the turbine centrifugal pump would be best suited.

Where there are a great number of wells each with a small capacity and as much water as possible is required. also where there is an exceptional amount of sand or silt in the water, the air lift is perhaps the best to use.

Class of Driving Power.

Pumps are usually driven either by electric motors, gasoline engines or steam engines. As gas engines and motors are mostly used we will only consider these. In the selection of a gas engine or motor one of the most important points to remember is not to install too large an engine motor. This not only increases the first cost but also the fixed charges such as: interest on the investment and the depreciation, which eventually will be charged against the cost of operation. If either engine or motor is belted, proper attention must be given to have the proper size pulley, so that not only the pump will operate at its proper speed, but that the belt speed will be high enough so that it will operate with the least amount of slippage. The best belt speed is about 4000 ft. per minute. On small pulley at the above mentioned belt speed it is preferable to have the belt wide and pliable rather than narrow and stiff, such as a double leather belt or a heavy canvass belt is apt to be.

In the purchasing of any kind of machinery, whether it is a pumping plant or some other kind, it is not always the cheapest to purchase the machinery that has the cheapest first cost. The manufacturer must have a fair price for what he furnishes. Competition has put a limit to exorbitant prices and I have found from experience that when purchasing machinery and when dealing with a reputable firm the purchaser usually gets what he pays for. If he buys cheap he generally gets cheap goods.

Fuel Cost.

In the gas engine the fuel costs consist of the cost of the gasoline or distillate consumed. The manufacturer of gas engines in talking with the prospective purchaser will usually claim and is willing to guarantee an efficiency of his engine of 1-10 of a gallon per h.p. per hour. This h.p. hour is usually based on indicated h.p. There is quite a difference between

indicated and brake h.p. as the indicated h.p. does not take the friction of the engine into consideration and a guarantee of 1-10 gallon per indicated h.p. is usually equivalent to about 1-8 of a gallon per brake h.p. When an engine is new and well adjusted they will come up to this efficiency, but after operating a while and getting out of adjustment they will consume from 1-6 to 1-7 of a gallon per h.p. hour.

In the electric motor the fuel cost consists of the cost of the current consumed.

Cost of Fixed Charges and Attendance.

Every dollar that is spent in making the installation should carry certain interest charges, for if the money were not used for the purpose of purchasing machinery it could be made to earn money for its owner in other places. The amount of interest to be charged depends upon the greatest average earning capacity in other investments. Usually, however, an arbitrary figure is used, varying anywhere from 6 to 10 per cent.

Fixed Charges on First Cost

	Engine. (per cent)	Motor. (per cent)	Power Plunger Pumps. (per cent)	Centrifugal Pumps. (per cent)	Air Compressors (per cent)
Interest	6	6	6	6	6
Depreciation.	8 to 10	5	8 to 10	7 to 10	7 to 10
Repairs	4 to 8	1 to 2	3 to 5	3 to 5	3 to 5
Total.....	18 to 24	12 to 13	17 to 21	13 to 10	16 to 21

The cost of attendance should not be lost sight of either as the best of machinery needs attention from time to time. Small plants usually do not have a constant attendant. They are usually taken care of by the irrigator. However his time is valuable and a charge should be made for it. The cost for attendance for a motor should not exceed 5 cents per hour as a motor requires a minimum of attention. A gas engine needing a great deal more attention should be about 10 cents per hour.

Repairs have to be made to nearly all classes of machinery. If nothing else, the machinery should be thoroughly overhauled at the beginning of each season.

The final selection of a pumping plant should be based on a careful consideration of the above mentioned factors. The best size of plant, the type of pump, the kind of driving power can only be correctly determined by a final consideration of the cost of installation and the cost of operation.

The following table shows the amount of h.p. (theoretical) required to lift water to different elevations, the miner's inch being based on 9 g.p.m.:

Theoretical Horsepower Required to Life Water.

In.	Total Lift in ft. that the Water is Lifted.									
	10	20	30	40	50	60	70	80	90	100
10	.225	.45	.67	.9	1.1	1.3	1.5	1.8	2.0	2.2
20	.45	.90	1.35	1.8	2.2	2.7	3.1	3.6	4.0	4.5
30	.675	1.35	2.02	2.7	3.3	4.0	4.7	5.4	6.0	6.7
40	.90	1.8	2.7	3.6	4.4	5.4	6.2	7.2	8.0	9.0
50	1.12	2.25	3.7	4.5	5.6	6.7	7.8	9.0	10.1	11.2
60	1.35	2.70	4.0	5.4	6.7	8.1	9.4	10.8	12.1	13.5
70	1.575	3.15	4.7	6.3	7.8	9.4	11.0	12.6	14.1	15.7
80	1.8	3.6	5.4	7.2	8.9	10.8	12.5	14.4	16.1	18.0
90	2.02	4.05	6.0	7.6	10.1	12.1	14.1	16.2	18.2	20.2
100	2.25	2.5	6.7	9.0	11.2	13.5	15.7	18.0	20.2	22.5

The following table gives the approximate percentage of fixed charges that should be used when figuring the selection of machinery:

PORTLAND CONVENTION N. W. ELECTRIC LIGHT & POWER ASSOCIATION.

The eighth annual convention of the Northwest Electric Light & Power Association was held at Portland, Ore., September 8, 9 and 10, 1915. The meeting was called to order at 10 a. m., September 8, by Franklin T. Griffith, president of the Portland Railway Light & Power Company, who first introduced H. R. Albee, Mayor of Portland, who extended a hearty welcome to the members.

O. B. Coldwell, president of the association, then read his annual address, outlining the work of the association during the year.

President's Address.

During the year 44 new members were added, making a total membership of 172. A great volume of correspondence was handled and advice given on a number of problems confronting member companies.

The overhead line committee, after a thorough study of the California Railroad Commission report on inductive interference, sent a letter to the various public service commissions, setting forth those portions of Order No. 39 regarded as detrimental to central stations. The committee also co-operated in formulating rules of overhead line construction in Idaho. Considerable attention was also devoted to the Bureau of Standards proposed safety code.

The public policy committee devoted most of its attention to such legislative matters as the certificate of necessity and convenience, indeterminate permit, taxation, hydroelectric commission act, home rule and jitney busses.

During the year a closer affiliation and better relations were established with the N. E. L. A. by increasing the representation from the West. Better relations were also established with the electrical contractors.

Special attention was called to the necessity of determining the cost of service for different classes of service. This involves the determination of the units of property devoted especially to each individual class and the proper apportionment to each class of such property as is jointly used by two or more classes.

In connection with valuation for rate-making purposes due consideration should be given to the fact that most of the companies were in business before the passage of the public utility laws and were financed in accordance with established business practices of the period. Franchises were considered to be valuable property rights. Franchises are now supposed to form no part of the value which should be allowed a company as a basis for rates. Regulation is the order of the day and in its practice, no uniform basis has yet been established. In the transition period, the industry should have an opportunity to accustom itself to the new conditions before any attempt is made to apply new principles which have no relation to the historical development of the business. A determination of the fair amount for rate making purposes on the basis of the present depreciated value of the physical property, disregarding intangible values and giving no opportunity to recover losses suffered in establishing the business, would by the impairment of credit, work an injury on the community as well as upon the business itself.

Much interest has been aroused in methods of planning work and keeping costs and it is now recognized that many of the ordinary operating and maintenance practices can be subjected to planning methods with beneficial results.

In the operation of schools today, electricity takes an important part. Much practical instruction along mechanical and electrical lines is attempted and large sums have been spent in equipping electric laboratories and shops. Electricity has also been employed to some extent in the cooking classes.

There is a good opening here for central station companies in seeing to it that Young America is taught all there is to know about the uses to which electricity may be put in the home, in the school and factory and on the farm. It was recommended that the association offer assistance through its member companies to school boards in the selection of suitable electrical studies and the arrangement of courses and that an educational committee be appointed for the purpose of studying this subject.

It is of the utmost importance that sane and sound legislation be enacted by Congress or proper interpretation be given of existing laws to permit the opening up and development of the water powers of the West.

President Coldwell's suggestion to educate the youth of the land—the heads of the future household—in the use of electricity, found ready response from L. R. Alderman, superintendent of the Portland city schools. Mr. Alderman urged co-operation between the electric distributors and the school authorities in teaching boys and girls in the public schools the value and the use of electricity.

E. W. Lloyd of Chicago, president of the National Electric Association, made a few remarks and pointed out that the reason why the West had not had more representation in the association was the fact that they had been indifferent and have not taken enough interest in the affairs of the association, but now their attitude had changed and he saw no reason why they should not get proper representation.

The afternoon was devoted to hearing and discussing papers on the following subjects:

The Small Consumer Question.

H. E. Eisenmenger presented the results of an investigation of the manner in which European central stations handle small consumer business at a profit and made suggestions as to how these methods could be adapted to American practice. He advocated a flat rate and an automatic current limiter as the best means of cutting the cost of meter reading, billing, collecting, etc., and as an inducement for new business. Details were given for a system of neighborhood bill collection agencies.

Cost Apportionment.

J. A. Rockwood analyzed the assignment of the various expenses of the electric light and power business so that the cost of service to various classes of consumers may be determined. Responsibility of the class for the investment is the governing principle. Apportionment of operating expenses, insurance, damages, taxes, investment and depreciation were discussed in detail in connection with charts of actual conditions.

In the afternoon the ladies were given automobile rides about the city, and in the evening a special electric train carried the delegates to station L of the Portland Railway, Light & Power Company, where Mr. E. D. Searing of the Portland Railway Light & Power Company read his paper on "Special Features of Stand-By Steam Power Plant Designs." A special orchestra furnished the music for dancing and refreshments were served.

Stand-by Steam Power Plants.

E. D. Searing described Section L of the Portland Railway, Light & Power Company and outlined the general method of operation, laying particular stress on the use of various recording meters to give accurate records of daily performance.

Technical sessions were resumed on Thursday morning with the consideration of the following papers:

Overhead Line Construction.

The committee on overhead line construction reported results of investigations of new Idaho rulings on line construction, California rulings on inductive interference, proposed national electric safety code and effect of N. E. L. A. requirements in Western companies. The first are highly commended, caution is urged with regard to the second and third, and progress was reported toward a satisfactory adjustment of the fourth.

Selling Small Appliances.

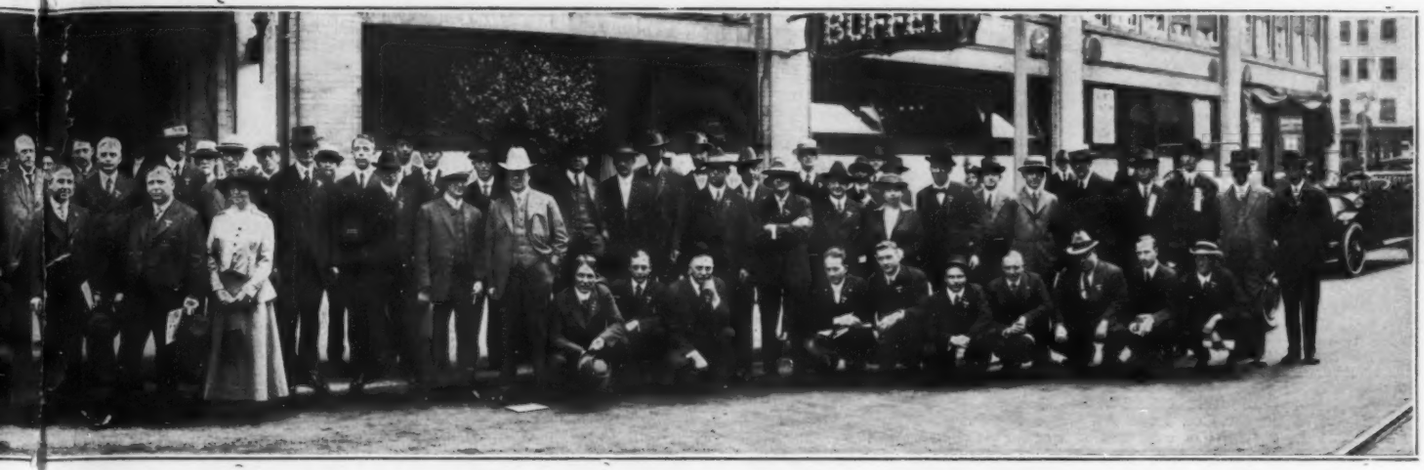
L. M. Simpson and H. B. Peirce discussed means of dedeveloping the small motor and appliance load to compensate for reduction in lighting income due to more efficient lamps and lower rates. Special attention is given to methods of selling to women, together with feature methods and advertising. A request is made for the standardization of appliance plugs and of small motor buses. Experience seems to favor the one-meter system with graduated rates.

At noon the Western Electric Company furnished a free luncheon to the delegates, about 100 being served in the parlors of the Multnomah Hotel. All of the dinner was cooked on a Hughes range. The ladies were entertained by a luncheon at the Waverley Country Club.

Abstracts of other papers presented on Thursday and Friday following, the report of electric range committee being printed elsewhere in these columns.

Practical Application of Modern Illumination.

F. H. Murphy and G. A. Kumler presented a paper of practical lighting details. After defining the several illumination units, they laid down the general principles which give efficiency, comfort and harmony in lighting installations. The merits of various types of reflectors and lamps were dis-



cussed together with an outline of methods, tables and curves employed to design lighting installations, giving detailed discussion of several typical classes.

Determination of Maximum Demand.

V. H. Greisser and H. B. Peirce, after showing that the consumer's maximum demand determines the cost of electric service, discussed the several methods of determining the maximum demand. Among non-instrumental methods these include the connected load, the assessed valuation of the property or the floor area of the house. Instrumental methods include integrating meters, graphic instruments and indicating meters. "When all the limitations surrounding the determination of individual demands are considered . . . . it is good commercial policy to consider only class demands in determining rates and to use demand meters only in the case of the large consumer whose individual demand will seriously affect the system load factor of the central station."

At the closing session resolutions were adopted calling attention to the unlimited water powers of the West, and to the present inability of capital to develop this great natural resource on account of the lack of encouraging legislation. The need for legislation that will make it possible to finance water power development was strongly pointed out. The complete resolution is as follows:

Whereas, the greatest natural resource of the West is its unfailing water power, at the present time in a large part undeveloped, which if developed would be an example of true conservation of our natural resources, due to the saving in consumption of fuel which would thereby result; and

Whereas, water power is the cheapest form of energy and its greater use would be a factor in cutting down the cost of living and increasing the comforts of the people of our commonwealth; and

Whereas, it is of first importance to the people of the Western states wherein these water powers abound that legislation be enacted to encourage capital to invest in water power development; and

Whereas, the central station companies in the West are already to a large extent dependent upon water power for the production of electricity, and as time goes on and this Western region grows, as it must, will be in an increasing degree looking to the water powers on the government domain to take care of the growth; therefore, be it

Resolved, That we, the members of the Northwest Electric Light & Power Association, in convention here assembled, recognizing that it is of prime importance to the development of the West that such legislation be passed as will make possible the ready financing of water power projects, hereby respectfully call to the attention of the Congress of the United States the need of action looking to the passage of such legislation, and hereby direct the president and executive committee of this association to take steps to bring this important matter to the attention of the members of Congress of the Western states.

The following officers were elected: President, E. G. Robinson, Arlington, Wash.; vice-president for Washington, H. J. Gille, Seattle; vice-president for Oregon, Attilla Norman, Eugene; vice-president for Idaho, E. P. Bacon, Boise; vice-president for Montana, J. P. Roche, Billings. Executive committee: J. M. Kinkaid, Port Townsend, Wash.; M. C. Osborn, Spokane, Wash.; J. E. Davidson, Portland; O. B. Coldwell, Portland; N. W. Brockett, Seattle; Arthur Gunn Wenatchee, Wash.; P. A. Bertrand, Aberdeen, Wash.; L. B. Faulkner Olympia, and W. J. Grambs, Seattle. The next convention will be held at Seattle.

The meetings came to a close with a banquet at the Multnomah Hotel. This banquet was served to introduce the "dual umpire" system. The entertainment committee could not agree on the toastmaster, so L. A. McArthur and A. C. McMicken presided jointly. There was keen rivalry between them in the eloquence of their introductory speeches.

The principal speaker of the evening was C. C. Chapman, who presented figures that showed in convincing form the results of discouraging capital in developing the resources of the Northwest. He pointed out that in the "fat years," from 1903 to 1912, Oregon exported $800,000,000 worth of products, and that in the same period virtually $1,000,000,000 of outside capital was invested in the development of the state. He contrasted this condition with the several years of the immediate past, during which virtually no outside capital has been invested. The reason he attributed to discouraging legislation. The remedy, he declared, is obvious.

The list of those registering follows:

Clyde B. Aitchison, Public Service Com. of Oregon, Portland.
Ray W. Turnbull, General Electric Co., Portland.
W. E. Peters, Western Electric Co., Portland.
Miss Mary G. Dry, Hughes Electric Heating Co., Chicago.
S. M. Kennedy and wife, So. California Edison Co., Los Angeles
P. E. Algee, Portland Railway, Light & Power Co., Portland.
A. L. Brown, University of Texas, Austin, Texas.
Guy W. Talbot, Pacific Power & Light Co., Portland.
R. R. Robley, Portland Railway, Light & Power Co., Portland.
D. C. Bralean, H. W. Byllesby & Co., Tacoma, Wash.
R. M. Boylin, Washington-Oregon Corp., Vancouver, Wash.
B F. Donahue, Washington-Oregon Corp., Vancouver, Wash.
H. L. Haines, Washington-Oregon Corp., Vancouver, Wash.
Jay S. Grou, Northwestern Electric Co., Portland.
W. M. Hamilton, Portland Ry., Light & Power Co., Salem, Ore.
R. R. Easter, Washington-Oregon Corporation, Hillsboro.
B. M. Atkins, Washington-Oregon Corporation, Kelso.
R. C. Kennedy, Wenatchee Valley Gas & Elec. Co., Wenatchee.

E. S. Code, W. E. Power Co., Seattle.
H. V. Gates, H. P. & E. Co., Portland.
F. D. Weber, Underwriters' Bureau, Portland.
Geo. Boring, Pacific States Electric Co., Portland.
V. E. Gates, General Electric Co., Spokane.
W. F. Hynes, General Electric Co., Portland.
David B. Rushmore, General Electric Co., Schenectady.
Wm. M. Wood, Pacific Power & Light Co., Lewiston, Idaho.
W. Sampson, N. S. S. P. Co., Portland.
H. B. Peirce, Washington Water Power Co., Spokane.
F. D. Baker, Sierra & San Francisco Power Co., San Francisco.
M. C. Morrow, Westinghouse Elec. & Mfg. Co., Pittsburg.
F. C. Hughes, The Glendive Ht. & Lt. Co., Glendive, Mont.
Albert S. Hall, Hood River Gas & Electric Co., Hood River, Ore.
C. E. Bailey, Pacific Power & Lumber Co., The Dalles, Oregon.
D. L. Lewis, Pacific Power & Light Co., Pomeroy, Wash.
J. F. Thompson, Sheridan Light & Power Co., Sheridan, Ore.
W E. Herring, P. S. T., L. & P. Co., Seattle.
Geo. E. Quinlan, P. S. T., L. & P. Co., Seattle.
M. T. Crawford, P. S. T., L. & P Co, Seattle
F M. Eidson, North Shore Light & Power Co., Ilwaco, Wash.
Robert Gray, Washington Water Power Co., Colfax, Wash.
V. V. Vercoe, Pacific Power & Light Co., Sunnyside, Wash.
V. H. Greisser, Washington Water Power Co., Spokane, Wash.
R. F. Monges, General Electric Co., Portland.
F. D. Nims, Olympic Power Co., Port Angeles, Wash.
J. M. Kinkaid, Key City Light & Power Co., Port Townsend, Wn.
P. D. Jennings, Puget Sound Traction Power Co., Seattle.
Geo. C. Sears, Puget Sound T., L. & P. Co., Deringer, Wash.
Ed. E. Walker, B. C. Electric Railway Co., Vancouver, Wash.
W. Goodman, Puget Sound T., L. & P. Co., Electron, Wash.
L. M. Simpson, Grangeville E. L. & P. Co., Spokane, Wash.
Geo. N. Rooker, Northern Idaho & Montana Power Co., Sand Point, Idaho.
H. J. Gille Puget Sound T., L. & P. Co., Seattle.
L. M. Shreve, Wenatchee Valley Gas & Elec. Co., Wenatchee, Wn.
H. E. Grant, Vancouver, B. C.
C. R. Dederick, Fobes Supply Co, Portland.
J. M. Chamberlain, Fobes Supply Co., Portland.
H. F. Holland, Simplex Elec. Heating Co., Los Angeles.
M. G. Lloyd and wife, Electrical Review, Chicago.
D. C. McKussick and wife, N. W. L. & P Co., Wallace, Idaho.
H. I. Matthew, Society for Electrical Development, New York.
C. J. Edwards, Coast Power Co., Tillamook, Ore.
R. U. Steelquist, Oregon Power Co., Corvallis, Ore.
C. L. Shattuck, Des Chutes Power Co., Prineville, Ore.
L. E. Hyde, Des Chutes Power Co., Modross, Ore.
E. H. Wilcox, Great Western Power Co., San Francisco.
W. D. Peaslee, O. A. C., Corvallis, Ore.
H. W. Howard, Des Chutes Power Co., Prineville, Ore.
Lewis H. Lewis, W. W. P. Co., Spokane.
R. F. Poppleton, Century Electric Co., Portland.
C. H. Clearer, Granite Falls Electric Co., Granite Falls, Wash.
F. L. Stokes, Washington-Oregon Corp., Tenino, Wash.
M. C. Osborn, W. W. P. Co., Spokane.
A. Norman, Oregon Power Light Co., Eugene, Ore.
Paul Lebenbaum, Southern Pacific Co., Portland.
Alva W. Person, Official Reporter, Portland.
A. F. Douglas, H. M. Byllesby & Co., Tacoma.
D. F. Smith, H. M. Byllesby & Co., Kalispell.
N. B. McDonald, H. M. Byllesby & Co., Kalispell.
N. W. Brockett, N. S. T. L. W. Co., Seattle.
Elmer Dover, H. M. Byllesby & Co., Tacoma.
H. L. Bleecker, W. W. P. Co., Spokane.
Henry L. Gray, General Electric Co., Seattle.
S. V. Walton, Pacific Gas & Electric Co, San Francisco.
A. Emory Wishon, San Joaquin Light & Power Co., Fresno.
Arthur D. Lord, H. M. Byllesby & Co., Tacoma.
E. G. Robinson, Jim Creek W., L. & P. Co., Hilington, Wash.
F. H. Harrmon, Eastern Oregon Light & Power Co., Baker, Ore.
W. H. P. Hill, Northwestern Electric Co., Portland.
J. F. Kinder, Dover Electric Iron Co., Portland.
C. C. Turlay, Portland Railway, Light & Power Co., Vancouver.
Stacy Hamilton, P. R., L. & P. Co., Portland.
A. L. Martin, Oregon Power Co., Dallas, Oregon.
O. B. Helt, General Electric Co, Portland.
J. White, Oregon Power Co., Albany, Ore.
W. S. Turner, Consulting Engineer, Portland.
Will Spaulding, Milburn Light & Electric Co., Portland.
James E. Davidson, Pacific Power & Light Co., Portland.
John J. Jennings and wife, Lewiston, Idaho.
D. F. Fearing, National Carbon Co., Cleveland, Ohio.
Carl L. Wernicke, Westinghouse Elec. & Mfg. Co., Portland.
C. L. Brown, Kenton Tract. Co., Portland.
H. E. Eisenmenger National Lamp Works of G. E. Co., Cleveland, Ohio.
G. H. Gumler, General Electric Co., Portland.
I. H. Shorno, General Electric Co., Spokane.
G. N. Barken, General Electric Co., Portland.
A. W. Sherwood, Jr., Portland Ry., L. & P. Co., Portland.
B. H. Swan, Pacific P. & L. Co., White Salmon, Wash.
J. G. Hawkins, Pacific P. & L. Co., North Yakima, Wash.
M. J. Wilkinson. Pacific P. & L. Co., Walla Walla.
O. B. Goldman, Portland Pump Co., Portland.
Scott Redfield, P. Ry., L. & P. Co., Portland.
F. I. Fuller, P. Ry., L. & P. Co., Portland, Ore.
J. C. Naylor, Pacific P. & L. Co., Goldendale, Wash
J. L. Day, P. Ry., L. & P. Co., Portland
J. A. Kimmel, P. Ry., L. & P. Co., Portland
J. A. Brownson, P. Ry., L. & P. Co., Salem.
Geo G Bowen, N. W. Elec. Co., Portland.
Wm. N. Volgtly, Pacific P. & L. Co., Kennewick, Wash.
G. D. Longmuir, Pacific P. & L. Co., Pasco, Wash.
C. C. Crawford, Portland, Ry., L. & P. C., Portland.
W. H. Crawford, Chas. C. Moore & Co., Portland.
H. E. Morton, P. Ry., L. & P. Co., Salem, Ore.
Fred C. Todt, Pacific States Electric Company, Portland.
Sydney P. Clarke, P. Ry., L. & P. Co., Philadelphia, Pa.
G. F. Harris, Pacific P. & L Co., Portland, Ore.
B. L. Kerns, W. E. & M. Co., Seattle.
O. B. Gates, Hillsboro P. & L. Co., Hillsboro, Ore.
C. M. Hill, Fobes Supply Co., Portland.
Rasamond Adams, Fobes Supply Co., Seattle.

G. I. Drennan, Pacific P. & L. Co., Toppenish, Wash.
Eck. Baughm, Pacific P. & L. Co., North Yakima, Wash.
E. H. Le Tourneau, Portland Ry., L. & P. Co., Portland.
J. A. Rockwood, P. Ry., L. & P. Co., Portland.
C. P. Osborne, P. Ry., L. & P. Co., Portland
H. H. Wade, P. Ry., L. & P. Co., Portland.
J. D. Scott, P. Ry., L. & P. Co., Portland.
F. H. Murphy, P. Ry., L. & P. Co., Portland.
H. H. Wakeman, P. R., L. & P. Co., Portland.
J. C. Henkle, P. Ry., L. & P. Co., Portland.
E. D. Searing, P. Ry., L. & P. Co., Portland.
R. T. Strong, P. R., L. & P. Co., Portland
H. C. Schade, P. Ry., L. & P. Co., Portland
W. P. Strandburg, P. Ry., L. & P. Co., Portland.
A. C. McMicken, P. Ry., L. & P. Co., Portland
G. W. Jett, P. R., L. & P. Co, Portland
R S. Carroll, P. Ry., L. & P. Co., Portland.
R. M. Boykin, P. Ry., L. & P. Co., Vancouver, Wash.
N. Ward, P. Ry., L. & P. Co., Vancouver, Wash.
A. L. Moody, General Electric Co., Portland.
A. L. Caldwell, Portland, Ry., L. & P. Co., Portland.
C. N. Huggins, Portland Ry., L. & P. Co., Portland.
F. W. Hild, Portland, Ry., L. & P. Co., Portland.
W. C. Heston, Portland, Ry. L. & P. Co., Portland.
S. Frank New, Portland Ry., L. & P. Co., Portland.
G. Canada, General Electric Co., Portland.
E. S. Whitney, General Electric Co., Portland.
Roy W. Turnbull, General Electric Co., Portland.
R. F. Monges, General Electric Co., Portland.
C. R. Wallis, General Electric Co., Portland.
R. M. Townsman, Portland Ry., L. & P. Co., Portland.
H. Allen, Portland Ry., L. & P. Co., Portland.
C. E. Condit, N. W. Electric Co., Portland.
F. O. Broili, N. W. Electric Co., Portland.
W. H. O. Hill, N. W. Electric Co., Portland.
L. T. Merwin, N. W. Electric Co., Portland.
H. W. Messinger, P. Ry., L. & P. Co., Portland.
W. B. Price, P. Ry., L. & P. Co., Portland .
W. R. Cornell, P. Ry., L. & P. Co., Portland.
L. Cramer, P. R., L. & P. Co., Portland
Geo. J. Kelley, P. Ry., L. & P. Co., Portland.
R. F. Olson, Portland Ry., L. & P. Co., Portland.
W. H. Lines, Portland Ry., L. & P. Co., Portland.
B. F. Boynton, Portland Ry., L. & P. Co., Portland.
F. J. Lonergon, Portland Ry., L. & P. Co., Portland.
Fred Cooper, Portland Ry., L. & P. Co, Portland
H. C. Kendall, Portland Ry., L. & P. Co., Portland.
F. O. Hunt, Portland Ry., L. & P. Co., Portland.
R. T. Leiter, Portland Ry., L. & P. Co., Portland.
T. Humfrey, Portland Ry., L. & P. Co., Portland.
W. J. Morris, Portland Ry., L. & P. Co., Portland.
A. D. Norris, Portland Ry., L. & P. Co.
R. S. McBride, Bureau of Standards, Washington, D. C.
A. Molesworth, Portland Ry., L. & P. Co., Portland.
Franklin T. Griffith, Portland Ry., L. & P. Co., Portland.
C. F. Richardson, P. Ry., L. & P. Co., Portland.
Henry Berger, Jr., Portland.
Frank I. Jones, Portland.
Will Spaulding, Portland, Ore.
Geo. Bowen, Northwestern Electric Co., Portland.
A. H. Kruel, Portland Ry., L. & P. Co.,
J. L. Shaw, Portland Ry., L. & P. Co.
C. C. Chapman, Oregon Voter, Portland.
H. P. Vickry, Portland Ry., L. & P. Co., Portland.
F. P. Brace, Portland Ry., L. & P. Co., Portland.
H. H. Gills, Oregon Power Co., Eugene, Ore.
L. G. Fear, Westinghouse E. & M. Co., Portland.
W. L. Oreman, Hughes Electric Heating Co., Chicago.
J. L. Shell, P. Ry., L. & P. Co., Portland.
S. W. Garrison, P. Ry., L. & P. Co., Portland.
A. N. Derby, John A. Roebling Sons Co., Portland.
Robt. C. Coffy, H. M. Byllesby & Co., Everett, Wash
J. B. Kilmore, P. P. & L. Co., Astoria, Wash.
S. B. Clark, N. W. Electric Co., Portland.
A. K. Baylor, General Electric Co., New York.
W. R. Putnam, Utah P. & L. Co., Salt Lake City.
G. W. A. Hughes, Hughes Electric Mfg. Co., Chicago, Ill.
J. I. Colwell, Western Electric Co., Seattle.
T. H. T. Oley, Bend W., L. & P. Co., Chicago.
F. A. Bayless, Grangeville Elec. L. & P. Co., Grangeville, Idaho.
A. M. Chitty, Puget Sound International Ry. & Power Co., Everett, Wash.
R. J. Pilkington, Astoria, Ore.
L. F. Harza, Consulting Engineer, Portland.
Eugene Enloe, Spokane.
J. F. Ryan, Western Electric Co., Portland.
J. V. Strange, Pacific P. & L. Co., Prosser, Utah.
S. C. Jagger, Morrison Electric Co., Portland.
Wm. G. Stearns, Standard Underground Conduit Co., Portland.
E. F. P. Schurer, American Electric Heating Co., Detroit.
Mary E. H. Hawley, P. Ry., L. & P. Co., Portland.
R. C. Reese, Prairie Power Co., Prairie City, Ore.
Eda Deiskill, P. Ry., L. & P. Co., Portland, Ore.
Allen F. Block, P. Ry., L. & P. Co, Portland.
H. L. Vorse, N. E. R. Bureau, Portland
A. C. Foss, Fobes Supply Co., Portland.
L. Gillmore, P. Ry., L. & P. Co., Portland.
R. L. Webb, Portland Eff. Engr. Co., Portland.
E. H. Richardson, Hartford Electric Htg. Co., Ontario, Cal.
H. L. Walther, California-Oregon Power Co., Medford, Ore.
P. E. Overend, Pacific States Electric Co., Portland.
Ross Hartley, Pacific States Electric Co., Portland.
E. A. Lloyd, Commonwealth Edison Co., Chicago.
J. C. McKusick, Wallace, Idaho.
H. A. Dennmore, R. P., L. & W. Co., Reno, Nevada.
J. K. Fairchild, Duquesne Light Co., Pittsburgh, Pa.
M. H. Nichols, Western Electric Co., Seattle.
J. L. Wright, General Electric Co., Seattle.
E. B. Luik, Westinghouse Electric & Mfg. Co., Pittsburg.
H. E. Plank, General Electric Co., Seattle.
W. E. Coman, Northwestern Electric Co., Portland.
J. M. De Lillis, Coast Power Co., Tillamook, Ore.
Frank Parrish, Fobes Supply Co., Seattle.

ELECTRIC COOKING CONDITIONS IN THE WEST.

BY W. R. PUTNAM, M. C. OSBORN AND S. V. WALTON.

(This article presents the essential details of a report on the subject presented at the convention of the Northwest Electric Light & Power Association, Sept. 8, 9 and 10, Portland.—The Editor.)

The reports from central stations show a total of 389,842 residence electric lighting customers. Of these, 220,042 are using gas for fuel and 2481 electricity, leaving 167,319 homes which use some other form of fuel, than gas or electricity. Half of this last number should become electric cooking customers during the next five years, provided there is a proper understanding of the importance of this business and efficient co-operation on the part of the central stations and the manufacturers of ranges.

The securing of this amount of business depends upon having:

A. Economical electric rates for cooking.

B. Moderate priced and yet efficient cooking and water heating equipment.

C. An active publicity and selling campaign, handled jointly by the central stations and the manufacturers.

Rates.

Cooking. The general opinion of all who have investigated electric cooking is that a 3-cent rate for this purpose, with 10 per cent cash discount, is necessary to compete with other fuels. On a B.t.u. basis electricity at this price cannot compete with other fuels, but due to its much more efficient mode of application and due to the much less shrinkage of electrically cooked foods, it is the opinion of your committee that this rate can secure the business, particularly if range manufacturers use fireless cooker features in their ranges and if customers use flat bottomed utensils on the top plates of the range. However, we wish to emphasize the opinion of many investigators, particularly those who are also interested in the gas business, that a rate of two cents is more nearly equal to 75 cent to 90 cent gas. On the other hand, many electric customers who are cooking with a three cent rate insist that their monthly bills are no greater than when cooking with gas.

Water Heating. In the opinion of your committee, water heating cannot be done economically at 3 cents. We believe that with the present style of heaters a rate of from ¾ cents to 1 cent is necessary. This is too low to be profitable and its only justification is its necessity in order to secure the cooking load at the higher rate. We are of the opinion that especial attention should be given in the future, as is now being done, by the manufacturers to the development of more efficient water heating devices.

If possible, electric water heating should be done by heaters of low wattage connected either to the system from 11 p. m. to 7 a. m. or at all hours of the day, excepting when the range is in use. This will necessitate a double throw switch at the customer's installation and will require exceptionally good lagging of customer's water tank and pipes. The advantage of this arrangement is the securing of either an "on-valley" load or a twenty-four hour load from residence customers, which will effect a considerable saving in investment on the part of the central stations and will be a justification for whatever rate may be finally determined upon, as necessary for this business.

Combination rate. Your committee believes that the final residential rate will be a block rate, with fairly high minimum bill, thus allowing the central station to furnish service in the house through one meter. In this connection we desire to cite the following rate, designed for this purpose by the Buffalo General Electric Company:

8c per kw.-hr for first 60 hrs. average monthly use of maximum demand.

5c per kw.-hr. for next 120 hours.

1½c per kw.-hr. in excess of 180 hours. No maximum demand figured less than 250 watts. Maximum demand shall be figured as 25 per cent of total installation, not including irons, heating devices, cooking devices, fans, vacuum cleaners and utility motors, not exceeding ½ h.p. in size.

A discount of 1c per kw.-hr. consumption billed on primary rate. $1.00 minimum.

In preparing such a rate some arrangement must be made to have the resulting costs to customers equitable as between different sized homes and yet not so complicated as to be confusing.

With 389,842 homes covered by this report, paying the central stations an average of $20.00 per year apiece, for electric lighting service, we appreciate the immense field for additional earnings, on our part, with a correspondingly small increased investment, from the use of lamp socket appliances, washing machines, vacuum cleaners, sewing machine motors, utility motors, air heaters, water heaters, refrigerating machines and electric ranges.

We cannot expect to increase the household expenses of our customers, but we must avail ourselves of every opportunity to substitute electricity for other agents in their homes, particularly when by so doing we materially improve home conditions.

Eventually we will secure average earnings of $60 per year from a large portion of our residence customers, and this increase of $40 per customer can be secured by an investment on our part of less than $70 per customer, including plant, transmission and distribution system. Meanwhile the operating expense per customer has very slightly increased, especially so in the case of hydroelectric plants.

In every instance of a commission in the Western States, we find that they have approved low rates for this purpose, apparently on the basis of "value of service." As yet we have been unable to find a single instance of serious objections on the part of customers using electric service for other purposes to the low cooking or heating rates.

Competition With Gas.

The following has been submitted by a combination gas and electric official and undoubtedly represents the attitude of combination gas and electric men:

"When the average efficiency of use of gas and electricity is taken into consideration the following table shows the rates for each that are comparable:

Gas at—Equals	—Electricity at
$0.75 per M.	1.25 cents per kw.-hr.
0.90 " "	1.50 " " "
1.00 " "	1.67 " " "
1.25 " "	2.08 " " "
1.50 " "	2.50 " " "
1.75 " "	2.92 " " "
2.00 " "	3.33 " " "
2.25 " "	3.75 " " "
2.50 " "	4.17 " " "

"As the rate for gas in most cases is not in excess of $1.50 per thousand cubic feet, and, in a large number of cases, particularly in the larger cities on the Pacific Coast, about $1.00 per thousand cubic feet, the rate for electricity, to make the cost of cooking the same, would be approximately 1.7c per kilowatt-hour. There are a few places, to my knowledge, where rate comparable to this is in effect. In one town in particular, in California, a cooking rate of 2c per kilowatt-hour is in effect, and in the same town gas is supplied at a rate of $1.25 per thousand cubic feet. Even under these conditions, where the actual cost to the consumer would be about the same, there are very few consumers cooking with electricity. There are probably several reasons for this, the first, and, in my opinion, the most important, being that the people have become accustomed to cooking with gas and are equipped with gas stoves, water heaters and other devices and do not like to change from something they know to be satisfactory to something that is in an experimental stage. The first cost of an electric range is another drawback and until the price is lowered considerably, people will not buy an electric range in place of a gas stove. Another reason is that there has not yet been developed a satisfactory electric water heater. There are several on the market, but none that give the satisfaction that a gas water heater does. Hot water, and plenty of it, is a necessity in every household and the gas water heater has made it possible to have all that is required on very short notice and at a very low cost. Until a satisfactory electric water heater is developed cooking with electricity is going to be held back in general, and particularly in territory where gas is available, for the reason that the consumer does not favor having a part of the kitchen equipment operated by gas and a part by electricity.

"There are certain obvious advantages in cooking with electricity, as compared to cooking with gas, such as greater cleanliness in the use of electricity, the fact that electricity does not burn up any of the oxygen in the room, thus, making an electric kitchen a healthier place in which to work, and possibly more important than either of the above, it has been found by actual test that food cooked by electricity contains more of the original weight than when cooked by gas. In some cases the saving amounts to from 15 per cent to 25 per cent of the original weight. As an instance, in broiling a steak the gas flame consumes considerable of the juice which has a very high nutritive value; with the electric broiler the juice is all saved, as there is no flame. With electricity the heating is under absolute control and exactly the right temperature can be maintained for any operation; with gas, no matter how careful the cook may be, there is bound to be considerable of a variation and the same condition of heat cannot be assured on all occasions.

"Looking at this subject in a broad way, I feel that the time has not yet arrived to even guess at the effect that cooking by electricity is going to have on the gas business. I feel that the use of gas for cooking, water heating and heating in general has already reached a wonderful state of development, and that the use of electricity for similar purposes is still in the experimental stage. Who knows what the possibilities for further development in each are? A few years ago it was heralded abroad by the electric light men that the incandescent lamp would put the gas men out of business, as far as lighting was concerned. One has but to study the lighting at the Panama-Pacific International Exposition, in San Francisco, to realize that the gas man is still in the lighting business. It is true that electricity for lighting has a greater field than has gas, and as a result artificial lighting has become practically one of the fine arts. There will undoubtedly be greater improvements in the methods of using electricity for cooking and heating purposes, so that its use will become more general. It is my belief, also, that the gas man will be found on the job and that the gas business in general will not be hurt, but on the other hand, will be improved as electricity becomes more of a competitor."

Your committe feel that many of the conclusions are correct, particularly that contained in the last sentence. We do feel that in case of competing companies in our Western cities that there will be active competition for the fuel business, but that business principles will for the most part require that the investment in gas systems be protected and that consequently the rapid development of electric cooking will but slightly if at all interfere with the present gas fuel business.

Selling Policy.

Under present conditions of range prices, lack of demand on part of customers, and general newness of the electric cooking game, we feel that it is necessary for central stations to do the bulk of the selling of ranges. However, as range prices go down, central stations should maintain their selling prices, so that electric supply dealers and hardware stores can sell ranges at a reasonable profit.

Ranges should be sold on time payments extending over six months or preferably one year; in case dealers are handling ranges the central stations may be obliged to finance their time payment sales; the cash price should be 10 per cent less than the time price.

If possible, costs of wiring should be worked out so that an average is determined and this should be added to the range price, so that when a sale is made the customer signs a contract containing a specified amount for the whole installation cost. In some instances, and particularly as an introductory argument, central stations may find it advisable to absorb the wiring cost.

The selling policy in regard to water heaters should be the same as for ranges.

Central Station Investment Required for Range Business.

The answers received, showing a wide variation in costs and yet covering a comparatively small number of installations, indicate that average installation costs for a considerable cooking business have not as yet been obtained in practice.

Consequently, engineers have worked out costs for a small country town which has just been connected to a nearby electric distributing system.

Following are the conditions:

Present System.

A. Connecting line to main system.
5 miles, 11,500 volts.
3 No. 6 iron phase wires, 1 No. 9 iron neutral wire, placed on 7 in. 35 ft. cedar poles with 250 ft. spans.

B. Distribution System.
Length of pole line in town, 11,000 ft.
Average length of spans, 165 ft.
Number of residences in town, 66.
Length of blocks, including width of street, 660 ft
Average length of spans, 165 ft.

Requirements for Handling Cooking Business of All Residences, Assuming That Each Has a 3600 Watt Range.

1.	Number of transformers	14
2.	Total transformer capacity	88 k.v.a.
3.	Average number of ranges per transformer	4.7
4.	Average length of secondary circuits	450 ft.
5.	Average distance from transformer to end of secondary	225 ft.
6.	Per cent of secondary consisting of 3 No. 4 copper wires	53%
7.	Per cent of secondary consisting of 3 No. 2 copper wires	47%
8.	Size of service leads—3 No. 6 copper	.....
9.	Assumed maximum demand of 66 ranges on feeder line	35 kw.

The above requirements are worked out on the following assumptions as to transformers and secondaries required:

1. Number of Ranges Connected to Transformer.

	Size of Transformer.
1	3 k.v.a.
2	5 "
3	5 "
4	5 "
5	7½ "
6	7½ "
7	7½ "
8	7½ "
9	7½ "
10 to 16 inclusive	10 "
17 to 25 inclusive	15 "

2. Capacity of Secondary Circuits for Electric Ranges.

(Based on 3 per cent secondary drop with 1500 watts load on one side 224 volt, 3 wire Circuit.)

Size of Transformer. (B. & S. Gage Copper).	Distance from Transformer. to One Range.
No. 6	260 ft.
No. 4	600 ft.
No. 2	850 ft.
No. 0	850 ft.
No. 000	1200 ft.

Effect of Cost on Present Extension If Each Residence Uses 3600 Watt Range.

1.	Number of residences	66
2.	Total investment required to serve the 66 residences with ordinary lighting, including feeder line, distribution system in town and meters	$5,400.00
3.	Additional investment required in feeder line to take care of ranges:	
	a. An induction regulator with same No. 6 iron wire	1,500.00
	or b, No. 6 copper wire instead of No. 6 iron	1,500.00
4.	Additional investment required in transformers	900.00
5.	Additional investment required in secondaries	500.00
6.	Additional investment required in services	300.00
7.	Additional investment required in meters	600.00
8.	Total additional investment required for ranges.	3,800.00
9.	Saving in investment under above situation in case we furnished residence service for both lighting and cooking on a combination rate, thus using only one meter	450.00
10.	Additional investment required if 25 per cent of customers had ranges	1,700.00
11.	Ditto— 50 per cent	2,500.00
12.	Ditto— 75 per cent	3,200.00
13.	Ditto—100 per cent	3,800.00
14.	Additional investment if all residences use a 600 watt water heater in addition to range, with double throw switch so installed that both range and heater cannot be used at same time—water heater flat rate	2,500.00
15.	Additional investment if all residences use a 2000 watt water heater in addition to range without double throw switch—water heater on meter	4,000.00

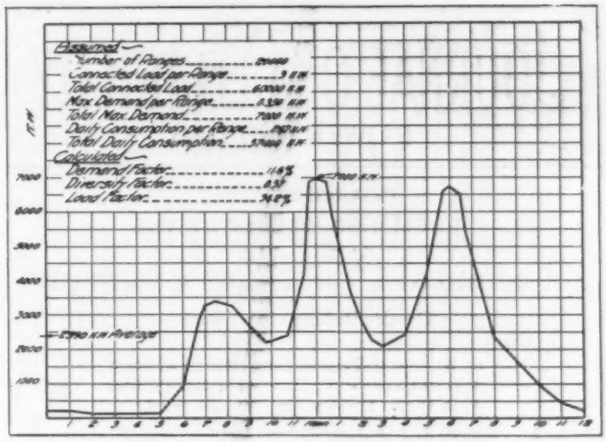
The above costs per customer are as follows:

Additional line or regulator	$ 22.73
Additional transformers	13.64
Additional secondaries	7.58
Additional services	4.55
Additional meters	9.09
Total	$ 57.59
Deduct in case one meter used for combination rate	6.82
Total	$ 50.77
Additional investment to handle 600 watt heater	37.88
Additional investment to handle 2000 watt heater	60.61

The engineer calls attention to the necessity of the neutral wire being as large as the outside wires with three wire secondaries handling ranges with 1500 watt 110 volt units on either or both sides of the neutral: A considerable saving could be made in secondaries if the larger units could be furnished at 220 volts.

These cost figures are based on a small scattered town and we are safe in assuming that the total investment in the average town outside of additional plant capacity will be $50 or less per range.

The load factor curves in this report show that the peak load of a large system with an assumed addition of 20,000 ranges is increased 190 watts per range; as a considerable portion of this can be carried by pondage in the case of hydroelectric systems and by the over-



Assumed Load of 20,000 Electric Ranges.

load capacity of steam equipment, the additional plant investment required will not exceed $20 per range; this gives a total of $70 from which investment we will secure an average annual earning of at least $30.

In reference to water heating, the investment figures submitted above are based even more on assumptions as to probable load factor than are the range figures; the central station additional investment, exclusive of plant, of $37.88 per 600 watt heater or $60.61 per 2000 watt heater does not appear desirable unless earnings of $24 to $40 per year are guaranteed from this business. The effect on the peak load of any system of the water heating load has not been determined, but it will probably be much worse than cooking load, although it will have an even better effect on the load factor. Special attention should be given by all concerned to the development of a water heater that could operate from 11 p. m. to 7 a. m.

With a total of some 160,000 homes to be supplied with electric ranges at say an average return to manufacturer of $35 apiece, the same number of water heaters at an average of $9 apiece, and a sale on the part of the manufacturer for each range of $12 in transformers, $8 in meters and $30 in supplies, we feel warranted in urging upon the manufacturer an exceedingly active co-operation in the development of this business.

Advertising and Publicity Work.

We want to so present the advantages of electric cooking on customers that they come to us demanding electric ranges instead of our having to use days of a salesman's time to secure one customer's order for a range. Our advertising must be aimed at this end.

A. Newspapers—live, snappy ads and stories can be used here to advantage.

B. Booklets, circulars and postcards.

C. Demonstration Work. This is especially necessary in introducing cooking, as nothing impresses the housewife, who knows nothing of electric cooking, as the actual cooking in her presence. However, if the experience of gas companies is a criterion, we can use demonstration to advantage for many years to come.

D. Cooking experts to follow cooking installations. This is of particular importance, as many housewives require several visits for instruction before they grasp the economical handling of their range and if this is not done, we are almost sure to have a lost customer, who will do us more harm than many satisfied customers can do good.

JOURNAL OF ELECTRICITY
POWER AND GAS

FOUNDED 1887

PUBLISHED WEEKLY BY THE

Technical Publishing Company

Crossley Building, San Francisco

E. B. STRONG. President and General Manager
A. H. HALLORAN. V. P. and Managing Editor
A. M. HUNT. Treasurer and Special Contributor
C. L. CORY. Secretary and Special Contributor
ROBT. SIBLEY Director and Special Contributor

CHICAGO OFFICE: 537 SOUTH DEARBORN ST.
JOSEPH H. EVERSTON. Advertising Representative

ON LIBRARY CARS OF ALL SOUTHERN PACIFIC TRAINS

TERMS OF SUBSCRIPTION.

United States, Cuba and Mexico	per year,	$2.50
Dominion of Canada	" "	3.50
Other Foreign Countries within the Postal Union	" "	5.00
Single Copies, Current Month	each,	.25

NOTICE TO ADVERTISERS.

Change of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

CONTENTS

Pacific Coast Electrochemical Possibilities 209
By J. W. Beckman.

Selection of Pumps for Irrigation 214
By C. Remschel.

Report of N. W. Electric Light & Power Association Convention .....

Electric Cooking Conditions in the West 221
By W. R. Putnam, M. C. Osborn and S. V. Walton.

Editorials 224
- The Inadequacy of the Flat Rate.
- Electric Cooking in the West.
- Electro-Chemical Possibilities.
- Synchronous Motors.

Personals 226

Meeting Notices 227

International Engineering Congress 227

New Catalogues 227

News of Idaho Public Utilities Commission 227

Prize Contest of Edison Lamp Works 227

Publications Received 227

News Notes 228

The Inadequacy of the Flat Rate

The resurrection of the flat rate as a means for stimulating small consumers to use electric service was advocated by Mr. H. E. Eisenmenger of Cleveland, Ohio, in a well written paper presented at the Portland convention of the Northwest Electric Light & Power Association. His arguments are so plausible and his reasoning so sound that his suggestions will undoubtedly be adopted with success in some localities. The flat rate will prove a strong stimulant in some Eastern cities, but is not adapted to Western communities.

Such a paper should be of great value to New York or the New England states, where congested centers of population exist. It is of little use in the West where the reverse condition prevails. Here in the West the problem of line extension into territory of sparse population is paramount. Many companies have but recently abandoned flat rates in favor of metered service. The average current consumption is much higher and even in the most congested portions of the cities most of the inhabitants are using electricity.

Electric Cooking in the West

The prospects for selling electric ranges in the West are most excellent, judging from the report presented at last week's meeting of the Northwest Electric Light & Power Association. While an unbiased observer cannot consider the electric range as economical as the gas stove there are many communities without gas service where the people welcome the convenience of electric cooking. There are also always a limited number who are willing to pay more for the luxury of electric cooking.

The most frequent objections to electric cooking are the high cost of electric ranges, the great cost of current and the slowness in cooking, as compared with gas ranges. The constant increase in output of electric ranges should materially reduce the price in the near future. Under the average conditions of use electricity at two and one-half cents per kilowatt hour is equivalent to gas at one dollar and a half per thousand. Many companies are making a rate of three cents or less, which is sufficient to hold much of the cooking load. The greater convenience and cleanliness of electric ranges compensate for the slowness in cooking.

The American habit of cooking and eating three meals a day is one which should be a source of profit to electric companies in years to come. The evolution from a luxury to a necessity is usually rapid in this day and age so that it should be but a matter of a few years before many families use electricity for this purpose if the public are properly educated on the subject.

This report represents the most exhaustive investigation into the situation which has yet been made. While it shows that there is an evident desire on the

part of the central stations to co-operate with the manufacturers there seems to be a tendency to ignore the dealer. Many far-sighted business men believe that this is a mistaken policy which may require time to correct. With the hearty co-operation of the dealers the hundred thousand prospects should yield a far better return than the five thousand new cooking consumers which twenty-six companies anticipate next year.

Before any great increase in sales can be expected, however, the cost of electric ranges should be materially reduced. This should be possible with standardization of design just as has been done in the case of vacuum cleaners, which sell for less than one-fourth the price quoted five years ago, and is being done in the case of electric washing machines.

Electro-Chemical Probabilities

What is needed to step up the possibilities of electro-chemical industries in the West to probabilities and then to transform them into realities? The possibilities which Mr. J. W. Beckman points out elsewhere in these columns, have been known for many years. But lo these many years they still remain passive potentialities! Why?

Of the raw products used in electro-chemical processes there is a great abundance, widely distributed and of easy access. Likewise the power supply, present and future, is more than ample, albeit not yet as cheap as has been developed in a few other localities. Sufficient labor is available to do the work, and the demand already exists so that a market can be created with little effort.

Here is every element but capital, the most essential factor in industry, socialistic doctrines notwithstanding. The magic touch of capital would stimulate these latent possibilities into vigorous life.

But capital is timid. It knows from experience that many costly experiments must be made before a laboratory experiment becomes a profitable industrial process. The losses are great in such pioneer work and the return not always commensurate with the risk, especially in view of the present tendency toward commission-limitation of return. And above all else there should be legislation to encourage the development of water power in the national forest reserves. Instead of the present policy of taxing hydroelectric development the country as a whole would profit if water power development were supported by government subsidies.

While there is, of course, no prospect of such subsidization, there is good reason to believe that the present restrictions to development will be removed at the next session of congress. This probability will then open the gate to the great opportunity for electro-chemical industries in the West.

Nearly three-fourths of the potential water power of the United States is running to waste into the Pacific Ocean. Less than one-tenth of this power has been developed and yet the people of the West are already enjoying lower rates for domestic service than elsewhere in the country. Over forty-four million horsepower can be developed west of the Rock Mountains without storage, according to the estimates of the U. S. Geological Survey.

Yet this power is not available from the practical standpoint of dollars and cents. Make it available by offering favorable terms for its development and the future of the electro-chemical industry will be assured. Thus can possibilities be stepped up to probabilities.

Before these probabilities can be raised to realities methods should be devised for increasing the consuming population. Although the shores of the Pacific offer a great potential market for electro-chemical products, this ought to be suppiemented by a home demand. The necessity for attracting new settlers to the West was emphasized by a number of speakers before the International Irrigation Congress which met in California during the past week. The raliroads have done much to promote colonization, and will do more, but should have the aid of other public service corporations. The irrigation companies are alive to the slogan "after the water, the people" and it may yet be necessary for the power companies to carry on similar work in the future.

Synchronous Motors

Good voltage regulation is second only to continuity of service among those elements whereby an electric lighting company is judged by the consumer. Flickering lights are responsible for many service complaints. While the ordinary feeder potential regulators compensate for the load drop in distributing circuits they are not always able to care for variations originating in long distance transmission systems.

Several years ago the synchronous motor was suggested as a means for correcting this trouble. The synchronous motor had long been known as a power factor corrector, but little used as a voltage regulator. However, when it was pointed out that not only could constant voltage be maintained at the receiving end of a long transmission line by this means, but also the power load on existing lines could be increased, a number of companies tried them out with such marked success that there now remains no question as to its utility.

Because of its influence in correcting voltage irregularities there seems to be a tendency for central stations to offer a bonus to those consumers who will install synchronous motors and operate them so as to conform to the needs of the line. There is every present indication that the synchronous motor is destined to a far greater field of application than it has enjoyed in the past.

PERSONALS

G. O. Vyne, electrical contractor of Prescott, Ariz., is at San Francisco.

C. E. Scribner, chief engineer of the Western Electric Company, New York, is at San Francisco.

W. Baldwin, electrical dealer at Klamath Falls, Ore., was visitor at San Francisco during the week.

H. A. Barre, of the Pacific Light & Power Company, Los Angeles, was a recent visitor at San Francisco.

F. H. Leggett, manager Western Electric Company, San Francisco, is planning to go to Seattle next week.

F. D. Weber, inspector for the Underwriters' Equitable Rating Bureau at Portland, Ore., is at San Francisco.

D. Hopkins, purchasing agent for the United States Verde Copper Company, Jerome, Ariz., is at San Francisco.

H. B. Peirce, assistant commercial agent Washington Water Power Company of Spokane, is at San Francisco.

A. E. Wishon, assistant manager San Joaquin Light & Power Corporation, has returned to Fresno from Portland.

M. Kondo Motoki, delegate from the Japanese navy to the International Engineering Congress, is at San Francisco.

A. E. Lemon, of the Truckee River General Electric Company, Reno, Nev., spent a few days at San Francisco this week.

C. E. Condit, assistant engineer, Northwestern Electric Company of Portland, was at San Francisco during the past week.

Percy H. Thomas, consulting electrical engineer at New York City, is at San Francisco, after a visit to Yosemite Valley.

H. Rothwell, engineer with the Ontario Hydroelectric Power Commission, is investigating high tension systems of the West.

G. Anderson, salesman of the Electric Appliance Company, for Arizona, is on a business and pleasure trip to San Francisco.

W. A. Burntrager, storekeeper and purchasing agent of the Olympia Light & Power Co., Olympia, Wash, is at San Francisco.

S. V. Walton, commercial agent Pacific Gas & Electric Company, San Francisco, Cal., returned the first of the week from Portland.

W. R. Putnam, of the Utah Power & Light Corporation, Salt Lake City, Utah, spent several days during the week at San Francisco.

Henry Vickars, interested in the sale of electrical household supplies, Hilo, Hawaii, was a visitor at San Francisco during the week.

Henry Karge, of the Nevada Telephone Supply & Construction Company, Carson City, Nev., spent the past week at San Francisco.

R. E. Cunningham, superintendent of Southern California Edison Company, has returned to Los Angeles after a visit at San Francisco.

Harry Fish, power apparatus salesman for the Western Electric Company, Los Angeles, spent a few days during the week at San Francisco.

C. E. Thompson, credit man of the Westinghouse Electric & Manufacturing Company, San Francisco, Cal., is on a business trip to Los Angeles.

J. B. Lukes, San Francisco representative of Stone & Webster Management Association, has returned from a brief vacation in Southern Oregon.

R. H. Coyne, representative of the Kellogg Switchboard & Supply Company, San Francisco, is on a business trip through Southern California.

E. A. Wilcox, commercial engineer, with the Great Western Power Company, San Francisco, has returned to San Francisco from Portland, Ore.

R. F. Monges, local engineer General Electric Company at Portland and **Jay L. Wright,** sales agent for the company at Seattle, are at San Francisco.

R. W. Van Norden, consulting engineer at San Francisco, has been appointed consulting engineer to the State Engineering Department of California.

M. C. Morrow, of the Westinghouse Electric & Manufacturing Company, San Francisco, Cal., returned the first of the week from a trip to Portland, Ore.

D. A. Chappell, president and manager Southern Sierras Power Company, and **C. O. Poole,** chief engineer, have been at San Francisco during the past week.

Wm. M. Werner has severed his connection with the Pacific States Electric Company to enter the firm of the Nevada Machinery Company, Reno, Nev.

C. E. Heise, manager Westinghouse Electric & Manufacturing Company, San Francisco, is making a motor trip through the coast counties of California.

Salvador Ugarte, machinery and electrical dealer of Guadalajara, Mex., is making a business and pleasure trip to California, and is at present at San Francisco.

A. E. Chandler, president of the California Water Commission, expects to attend the waterpower conference at Portland next week, having been appointed a delegate by Governor Johnson.

August Hund, doctor of engineering from the University of Carlsruhe, Germany, has been appointed a member of the faculty in electrical engineering at the University of Southern California, Los Angeles.

C. A. Binns has resigned from the sales staff of the General Electric Company at San Francisco to become head of the department of academics at the California Polytechnic School, San Luis Obispo, Cal.

David B. Rushmore, chief engineer power and mining department General Electric Company, attended the convention of the Northwest Electric Light & Power Association at Portland, and is now at San Francisco.

S. M. Kennedy, general agent Southern California Edison Company, stopped at San Francisco several days this week while returning to Los Angeles from the convention of the Northwest Electric Light & Power Association at Portland.

Al. Palmer, traveling representative of the Phillips Insulated Wire Company, who has been for several months past making a tour of Europe and the Orient, arrived last Monday from the Far East, en route to New York. He will spend several days on the Pacific Coast.

J. J. Carty, chief engineer American Telephone & Telegraph Company, and president of the American Institute of Electrical Eengineers; **Gano Dunn,** president J. G. White & Co., and past president of the Institute, and **F. L. Hutchinson,** secretary of the Institute, were among the electrical men on the special New York train to the engineering conventions at San Francisco this week.

Fred Goldman, instructor in electricity at Portland Trade School, Portland, Ore.; **Wm. R. Keyes,** electrical engineer Winnemucca Water & Light Company, Winnemucca, Nev.; **Laurids Lauridsen,** electrical engineering and testing, Portland Railway, Light & Power Company, Portland, Ore.; **Charles C. Snyder,** chief electrician Chanslor-Campbell, Midway Oil Company, Fellows, Cal., and **Norman H. Squire,** electrical contractor. Downieville, Cal., have been elected associate members of the American Institute of Electrical Engineers.

MEETING NOTICES.

Building Congress at San Francisco.

The National Association of Builders' Exchanges, at its convention in Columbus, O., last January, fixed the week of October 18 to 23 as American Builders' Week, to be observed at the Panama-Pacific Exposition at San Francisco.

Elaborate preparations are being made to properly carry out the objects of this convention. It will be of importance not only to builders, but to those interested in allied trades, such as the electrical contractors.

The ballroom at the Inside Inn will be the association headquarters, while the opening ball on the evening of October 18 will be held in the new auditorium at the Civic Center. A reception will be held during the week at the California State building, and on the evening of Saturday, October 23, there will be a banquet at the Palace Hotel.

Additional information regarding American Builders' Week can be obtained from the publicity committee, General Contractors' Association, 110 Jessie street, San Francisco, Cal.

San Francisco Electrical Development and Jovian League.

The opening meet of the fall term was held at a local cafe on September 8th, President George C. Holberton presiding. The appointment of the following committees was announced for the ensuing term:

Entertainment—S. V. Walton, Fred Poss, Hal Lauritzen.
Membership—W. S. Coleman, D. Harris, A. E. Drendell.
Ways and Means—W. H. Seaver, J. M. Barry, C. W. Mitchell.
Finance—F. H. Leggett, C. C. Hillis, T. E. Bibbins.
Grievance—W. S. Hanbridge, J. P. Bell, C. E. Wiggin.
Legislation—W. L. Goodwin, A. E. Elliott, C. F. Butte.
Society for Electrical Development—H. V. Carter, W. S. Berry, C. W. Hutton.
Live Wire—T. E. Collins, A. H. Halloran, C. L. Huyck, S. A. Hamilton, C. H. Tallant.
Standard Specification—Mr. Zimmerman, H. C. Reid, C. T. Philips, Fred H. Myer, R. M. Alvord, H. E. Sanderson, Garnett Young, F. Du Frane, D. Harris, A. Meinema.

In announcing these appointments, President Holberton stated that the newly created committee on standard specifications is to work in co-operation with the San Francisco architects toward securing a standard specification to eliminate the present variance in bids on electrical work.

As chairman of the day, F. H. Leggett introduced B. C. Carroll, general agent for the Pacific Telegraph & Telephone Company, who spoke on "Government Owned Telephone Systems," giving interesting comparisons between the government operated systems of Europe and the privately owned companies of America.

INTERNATIONAL ENGINEERING CONGRESS.

In addition to the technical program for the International Engineering Congress at San Francisco, September 20-25, as previously published in these columns, an interesting program of entertainment has been arranged.

On the evening of September 20th a reception and ball will be given at the Palace Hotel. On the afternoon of September 21st the ladies will be given an automobile ride through the city, and on September 23rd a lawn party will be given at Faculty Glade, University of California, Berkeley, in the afternoon.

On Friday evening, the 24th, a dinner will be given at the Palace Hotel, in honor of the honorary president and vice-presidents of the congress.

NEWS OF IDAHO PUBLIC UTILITIES COMMISSION.

The date for hearing the complaint of the Washington Water Power Company against the Montana Power Company, Thomson Falls Power Company, Federal Mining & Smelter Company and Tamarack & Custer Consolidated Mining Company has been postponed to November 9, 1915, at Boise, this being at the request of the several parties to the cause.

The commission has granted the request of the Great Shoshone & Twin Falls Water Company, by William T. Wallace, its receiver, to withdraw its application for an increase in the rates for electricity used in all class of air-heating service by means of electric air heaters or other heating appliances.

PRIZE CONTEST OF THE EDISON LAMP WORKS.

Last year the Edison Lamp Works of the General Electric Company instituted an original lamp selling campaign under the title "Edison Day"—the anniversary of the birth of the incandescent lamp. So successful was the campaign that this year the Edison Lamp Works decided to extend the Edison Day idea and incorporate with it a feature that will carry the campaign into the homes in a particularly effective way—the lamp selling prize contest for boys and girls. In pursuance of this idea the campaign was opened about September 1st, by advertisements describing the conditions of the contest in children's papers. These advertisements were followed by others that are appearing in the popular magazines.

Through the personal solicitation of the host of children that will be impressed into service through this contest, the central stations and agents handling the Edison Mazda are afforded an exceptional opportunity for making a top record in lamp sales. Through the children access is obtained directly to the homes, and where regular solicitors might be accorded indifferent consideration, the children will ingratiate themselves and reach the ears of their elders and bring in orders that would be inaccessible otherwise.

The contest will run from September 21st to October 21st, inclusive. The prizes will be awarded for the greatest wattage of lamps sold (i. e. the scoring will be by watts, not by the number of lamps. The prizes range from a $275 motorcycle (or an Edison phonograph and records of equivalent value if the winner be a girl) to motors, kodaks, rifles, etc., etc., down to flash lamps. Some 2000 prizes are offered in all. In very many cases the national prizes offered by the Edison Lamp Works will be supplemented by local prizes provided by the central station or agent. This feature is particularly recommended, as it adds to the contest a local interest that is an inestimable asset, and makes certain that a number of prizes will be distributed in the central station's immediate community.

NEW CATALOGUES.

Busch-Sulzer Bros. Diesel Engine Company have published in attractive pamphlet form a paper on "The Diesel Engine in Central Station Practice," as presented by E. B. Pollister before the Iowa division of the National Electric Light Association.

PUBLICATIONS RECEIVED.

"Looking Squarely at the Water Power Problem," by Henry J. Pierce of Seattle, Washington, is a book which the author has published in an effort to acquaint members of Congress and other legislative bodies with the need for a change in the existing laws on water power development.

Bulletin No. 4 from the office of the State engineer of Oregon summarizes available information on "Water Resources of the State of Oregon" as compiled and prepared under the direction of John H. Lewis, state engineer, in cooperation with the U. S. Geological Survey. Tabulated records of monthly discharges for all important streams in the state are presented.

NEWS NOTES

INCORPORATIONS.

SALEM, ORE.—The Portland Railway, Light & Power Company has been authorized to decrease its capital stock from $45,000,000 to $40,000,000.

HELENA, MONT.—Central Montana Telephone Company has been incorporated to build a telephone line from Hedgeville, in Meagher county, to Rygate, in Musselshell county, and branch lines when needed. Capital stock, $25,000. Alfred Bouchard, Berclair, is principal stockholder.

ILLUMINATION.

CORONA, CAL.—The Chambers of Commerce of Riverside, San Bernardino, Redlands and Colton are seeking extension of natural gas mains from Los Angeles to the valley.

PHOENIX, ARIZ.—The proposition for the formation of an electrical power unit to be known as Electrical District No. 1, was defeated at the recent election.

PHOENIX, ARIZ.—Bids will be called soon for furnishing 300 ornamental light standards required to complete the street lighting system.

DINUBA, CAL.—An ordinance has been adopted granting to the Parlior Winery a franchise to install a gas distributing system in the streets of the towns of Sultana, Orosi and Cutler.

LOS ANGELES, CAL.—Returns from the election for establishment of Woodcrest Lighting District were favorable and the city council has adopted a resolution forming the district.

MARTINEZ, CAL.—Manager T. D. Petch of the Contra Costa Gas Company, announces that that corporation has decided to provide an auxiliary plant. The outlay will be about $40,000.

HOOD RIVER, ORE.—Engineers of the department of engineering of the American Gas & Incineration Company, are seeking to secure a franchise from the city for installation of a gas plant here.

BELLINGHAM, WASH.—The council has passed an ordinance entering into contract with the Puget Sound Traction, Light & Power Company for the installation of a nitrogen tungsten system of lighting.

PILOT ROCK, ORE.—L. K. Harland and J. B. Sparks of Heppner were here recently to interview business men on the proposition of putting in an electric lighting plant. The plant will probably be installed before winter.

LOS ANGELES, CAL.—An ordinance has been adopted granting to the Southern Counties Gas Company a franchise to lay and maintain for a period of three years, a system of gas pipes along public streets and roads in Los Angeles county.

SANTA ANA, CAL.—Santa Ana is to have a system of ornamental lights for the principal business streets soon, if plans under consideration are carried out. There are to be some 70 poles, extending on Fourth from Mortimer to Ross streets and on Main from Second to Sixth streets.

MARTINEZ, CAL.—Application has been made by the Great Western Power Company for a franchise to erect lines, etc., for transmitting and distributing electricity along certain road highways of Contra Costa county. The board of supervisors will receive sealed bids for such franchise up to October 4th.

MANHATTAN BEACH, CAL.—The board of trustees has adopted a resolution ordering lighting posts on Fourteenth street between The Strand and Highland avenue, and Fifteenth street, between The Strand and the right-of-way of the Atchison, Topeka & Santa Fe Railroad, to be maintained and electric current furnished for two years.

SAUSALITO, CAL.—The town trustees have awarded a contract to the Pacific Fire Extinguisher Company of San Francisco for about one mile of electroliers. The system consists of 65 one-light compressed steel standard electroliers and connection of same with power company's lines, conduits having already been laid.

LOS ANGELES, CAL.—A man who stipulated that his name should not be made public, has presented the city of Venice with a $3500 electric display, to be erected at the ocean end of the Windward avenue pier. The light, which will be 100 ft high, will typify the rainbow, its proverbial pot of gold and the man eternally and futilely in pursuit.

EL PASO, TEX.—Work will be started shortly by the El Paso Gas Company on the Franklin street main that will represent an outlay of $15,000. The extension will consist of 16 inch and 12 inch pipe. Beginning at Franklin street, the extension will be carried up the alley between Mesa avenue and Stanton street to Wyoming street, east on Wyoming to the alley between Florence and Ochoa streets, north through that alley to the alley in the rear of Rio Grande street, thence east to Brown street.

TRANSMISSION.

REPUBLIC, WASH.—The survey has started for an electric power transmission line from Republic to Danville to connect with W. Kootenay Company's line from Bonnington Falls.

EUGENE, ORE.—The Eugene water board will build an auxiliary electric plant operated by steam to be used in case of accident to the hydroelectric plant near Waterville. The estimated cost is $50,000.

GLASGOW, MONT.—Hon. B. D. Phillips has signed a contract with the Montana Power Company to furnish electric power for the operation of the Ruby Gulch gold mining properties at Zortman, the Beaver Creek Mining Company and Dry Beaver and August Milling Company at Landusky.

OROVILLE, CAL.—Malcolm D. W. Greene, who owns mining property along Magalia Ridge, has filed application for 6000 miners' inches of water in Little Butte Creek. He states it is his intention to divert the water into ditches and carry it to the mining property, to be used to generate 1500 horsepower of electricity. L. A. Bunnell is associated with Greene in the project.

OGDEN, UTAH.—Franchises to run for 50 years have been granted to the Utah Light & Power Company by the city commissioners. The franchises as they were passed makes it possible for the Utah Power & Light Company to go ahead with extensive improvements which have already been planned and concessions are included which insure the saving of several thousand dollars each year to the consumers.

TUCSON, ARIZ.—The Department of the Interior has granted permission to the promoters to make preliminary surveys for the proposed six dams to be built in the Grand Canyon of the Colorado River, also for the site of reservoirs and hydroelectric plants to be constructed. J. B. Girard, city engineer of Phoenix, will have charge of the surveys. Interests closely identified with the Southern Pacific and Santa Fe are to finance the project. It is planned to provide electric power for operating the Arizona divisions of the two roads, furnishing electrical energy for operating machinery of mines and industrial plants, and for lighting systems of towns and cities over a wide stretch of territory. The hydroelectric plant will have a capacity of 400,000 horsepower. The first dam will be located in "Diamond Canyon," and will develop 50,000 horsepower.